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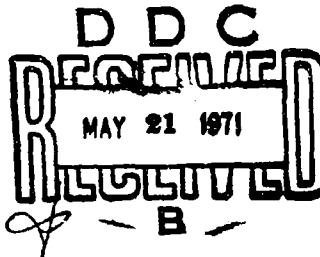
AFATL-TR-70-59

**TITI ENVIRONMENTAL EFFECTS
ON THE
PERFORMANCE
OF A
SINGLE FRAGMENT MUNITION**

**DAMAGE MECHANISMS BRANCH
TECHNOLOGY DIVISION**

TECHNICAL REPORT AFATL-TR-70-59

JUNE 1970



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ABSTRACT

The Tri-Service Degradation Effects Program (DEP) is studying the behavior of single projectiles in selected environments. This report covers the testing of various small arms ammunition in a titi environment. The project involved the determination of projectile velocity decay, projectile deflection, and projectile stability.

The testing consisted of Mann barrel firings through a system of velocity screens and witness panels which were placed at predetermined intervals in the titi environment. The test area was surveyed to establish the exact location of two twenty-five-foot sections of titi. Velocity measurements and deflection data were taken before and after each section of vegetation.

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SECTION I

INTRODUCTION

1. PURPOSE

The purpose of these tests was to study the behavior of single projectiles in a titi environment. The performance data was obtained for the Tri-Services Degradation Effects Program (DEP).

2. OBJECTIVES

The specific objectives of the tests were to:

- a. Determine the velocity decay for each projectile as a function of the distance traveled in the titi.
- b. Determine the deflection of each projectile as a function of the distance traveled in the titi.
- c. Determine the stability of each projectile and whether or not projectile break-up occurred.

3. TEST ITEMS

The following projectiles were tested in the titi environment:

- a. 7.62mm M80 ball at 2,750 ft/sec, mass = 147 grains
- b. 7.62mm M80 ball at 1,944 ft/sec
- c. 5.56mm M193 ball at 3,200 ft/sec, mass = 54.7 grains
- d. 5.56mm M193 ball at 2,300 ft/sec
- e. 10.3 grain steel flechette
- f. 23.9 grain steel flechette
- g. 68.2 grain 5.56mm ball
- h. .17 caliber ball, mass = 27 grains

Items a through d were tested at two heights. These items were of interest to DEP in determining the influence of titi on projectiles of a certain configuration. After several configurations are tested, the behavior of a theoretical configuration can be predicted.

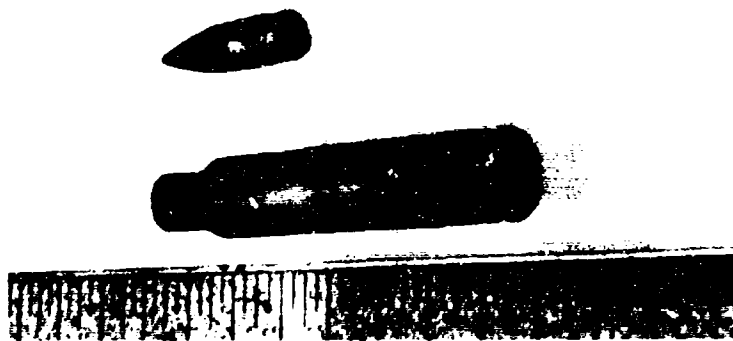
Items e through h were tested at one height. These items were of interest to the Army Small Arms System Agency at Aberdeen. They are all experimental munitions about which projectile performance information was needed.

The 7.62mm M80 ball and the 5.56mm M193 ball are shown in Figure 1; the 10 3 grain steel flechette and the 23.9 grain steel flechette in Figure 2; and the 68.2 grain 5.56mm ball and the .17 caliber ball in Figure 3.

NOT REPRODUCIBLE



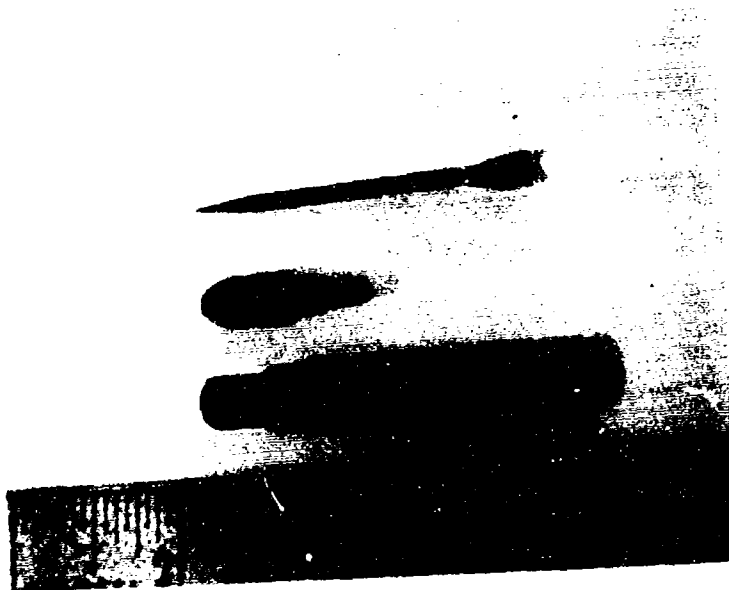
a. 7.62 mm M80 Ball



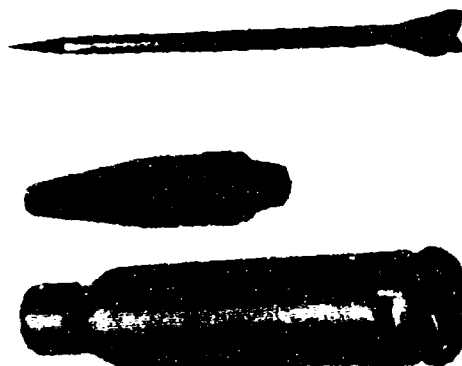
b. 5.56 mm M193 Ball

Figure 1. 7.62 mm M80 and 5.56 mm M193 Ball Projectiles

NOT REPRODUCIBLE



a. 10.3 Grain Steel Flechette



b. 23.9 Grain Steel Flechette

Figure 2. 10.3 and 23.9 Grain Steel Flechette Projectiles

NOT REPRODUCIBLE



a. 68.2 Grain 5.56mm Ball



b. .17 Caliber Ball

Figure 3. 68.2 Grain 5.56 Ball and .17 Caliber Ball Projectiles

SECTION II

TEST DESCRIPTION

1. TEST EQUIPMENT

The testing consisted of Mann barrel firings through a system of velocity screens and witness panels which were placed at predetermined intervals in the environment.

The equipment set-up used in testing the 7.62mm M80 ball and the 5.56mm M193 ball projectiles is shown in Figure 4. Three sets of velocity screens measured velocity of the projectiles at each of three locations. Five light screens were placed in front of the first section of vegetation, three light screens were placed between the first and second sections, and three Mylar® screens were placed behind the second section. Only two velocity screens are necessary at each location to obtain velocity data, but additional screens were used to insure that the necessary data was obtained when a screen did not operate properly. Witness panels were located at velocity screens 1, 6, 8, 9, 10 and 11. Kraft paper was attached to the light screens (1, 6, and 8) for this purpose. The Mylar® screens (9, 10, and 11) could be used without modification. The path of the projectile was determined by the hole locations in the screens.

The light screens operate through use of a light source and a photovoltaic pick-up cell. When the projectile passes between these, the photo cell senses the occurrence and the change in voltage from the cell starts an electronic counter to record the time.

The Mylar® screens consist of two thin conductive sheets separated by a thin sheet of insulation. A voltage is applied to the conductive sheets. When a projectile goes through the screen, the insulation is broken and a circuit is completed which sends a voltage to start a counter.

To reuse the Mylar® screen a high voltage is applied to the screen to burn it off. The torn pieces of the screen which completed the circuit are burned away and the conductive sheets are insulated from each other again. This makes the turn around time between shots considerably longer than when using light screens. However, the distance between the light source and the photo cell is limited for reliable operation. Hence, the Mylar® screens can be built to encompass a larger area for those applications where the projectiles are deflected to a great degree.

Figure 5 shows the relationship between counter readings and specific screens as well as providing the equations for calculating the necessary velocities.

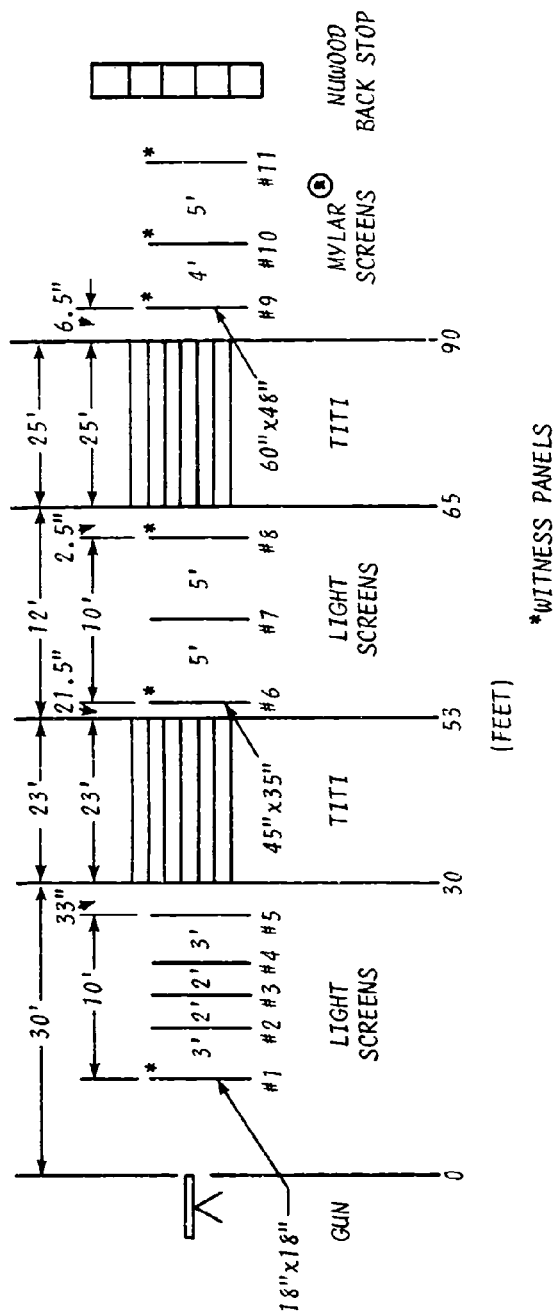


Figure 4. Equipment Set-Up for Testing 7.62 mm M80 Ball at 2750 Feet/Second, 7.62 mm M80 Ball at 1944 Feet/Second, 5.56 mm M193 Ball at 3200 Feet/Second, and 5.56 mm M193 Ball at 2300 Feet/Second

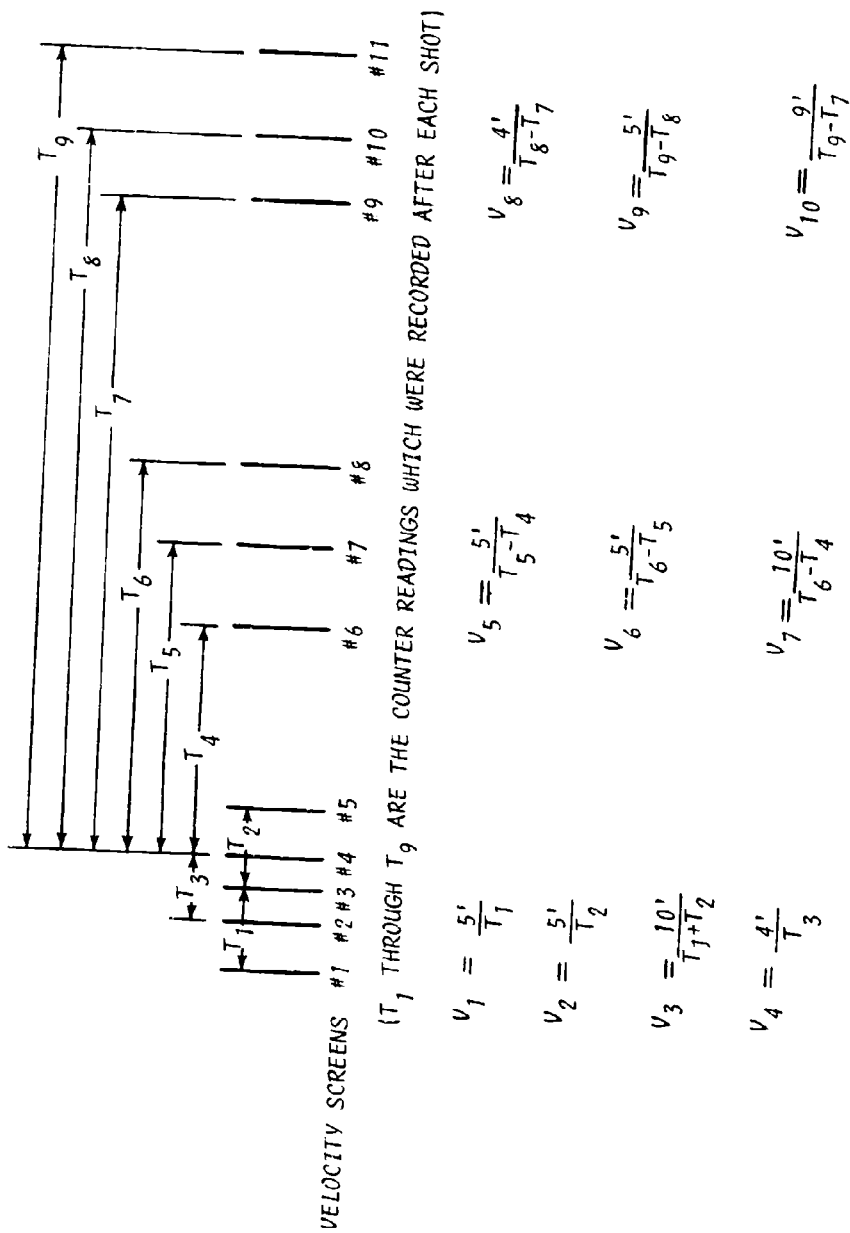


Figure 1. Velocity Screen and Counter Implementation for 7.62 mm M80 Ball at 2750 Feet/Second, 7.62 mm M80 Ball at 1944 Feet/Second, 5.56 mm M193 Ball at 3200 Feet/Second, and 5.56 mm M193 Ball at 2300 Feet/Second

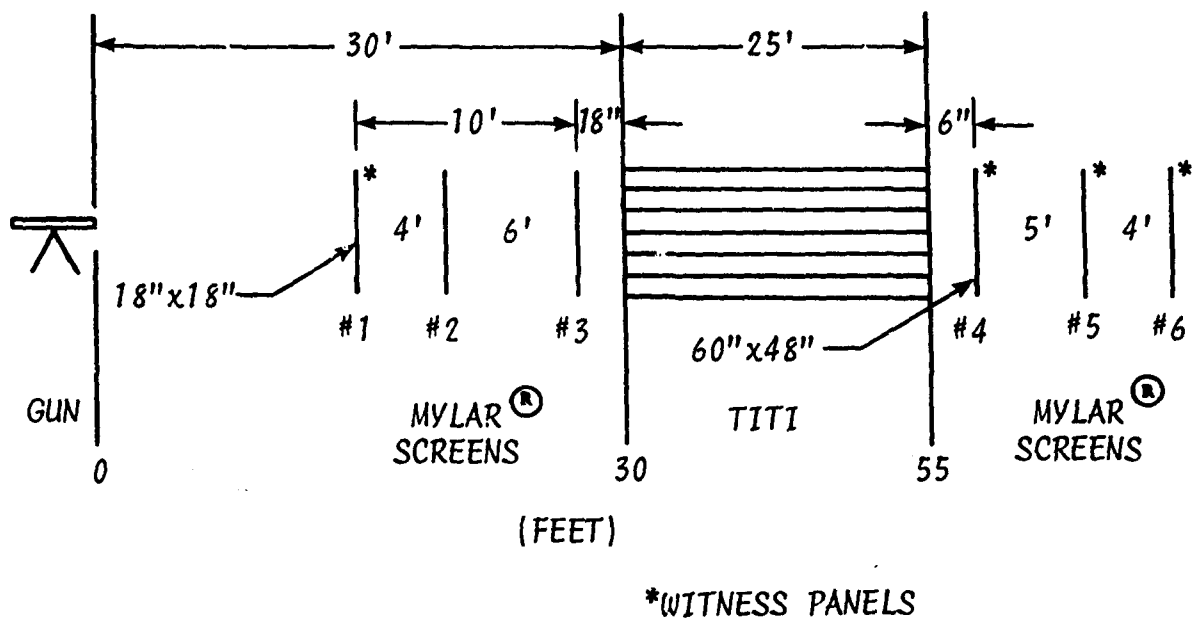


Figure 6. Equipment Set-Up for Testing 10.3 Grain Steel Felchette, 23.9 Grain Steel Flechette, 68.2 Grain 5.56 mm Ball, and 17 Caliber Ball

The equipment set-up used in testing the 10.3 grain steel flechette, 23.9 grain steel flechette, 68.2 grain 5.56mm ball and .17 caliber ball projectiles is shown in Figure 6. Three Mylar® screens were placed in front of the vegetation and three after the vegetation. Mylar® screens were used exclusively since some of the projectiles tested did not have a cross sectional area large enough to cause the light screens to function. Due to the large deflection pattern of some of the projectiles only one twenty-five-foot section of vegetation was fired through.

Figure 7 shows the relationship between counter readings and specific screens and furnishes velocity equations.

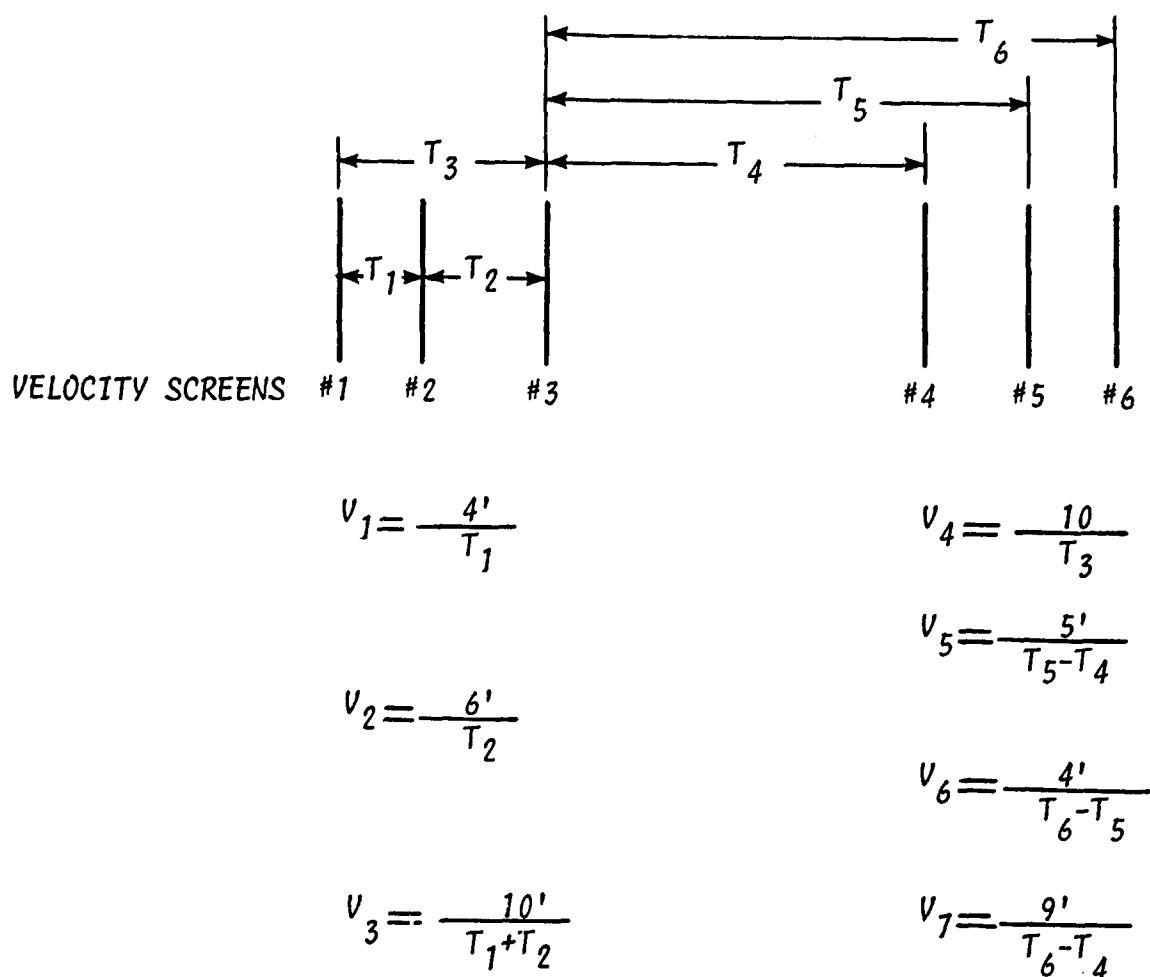


Figure 7. Velocity Screen and Counter Implementation for 10.3 Grain Steel Flechette, 23.9 Grain Steel Flechette, 68.2 Grain 5.56mm Ball, and .17 Caliber Ball

2. TEST PROCEDURES

The test area was first made ready for testing by cutting the vegetation for emplacement of the gun and velocity screens as shown in Figures 4 and 6. The area was surveyed to establish reference markers at the corners of the vegetation and planked to permit lateral movement of the gun and velocity screens. The screens could then be located in relation to the reference markers.

The following procedure was used for testing the projectiles:

- (1) Burn off each Mylar[®] screen individually to insure that it functioned properly and did not need to be rebuilt.
- (2) Position the Mylar[®] and light screens in the vegetation.
- (3) Make all electrical connections.
- (4) Turn on light screens and set the Mylar[®] screens at their operating voltage.
- (5) Test the set-up by probing all screens.
- (6) If no further adjustments were necessary, burn back the Mylar[®] screens and prepare for firing.
- (7) Position necessary witness panels on the light screens.
- (8) Mount the Mann barrel on the firing stand.
- (9) Align gun and velocity screens and note their location with respect to reference markers.
- (10) Obtain clearance to fire from the safety officer.
- (11) Prepare Mann barrel for firing.
- (12) Note weather conditions and any unusual or noteworthy circumstances.
- (13) Fire the round.
- (14) Turn off power to the screens.
- (15) Record counter times for velocity computation.
- (16) Mark the path of the projectile on the witness panels and measure the coordinates.

(17) Note if and when the projectile became unstable or if projectile break-up occurred.

(18) Move gun and screens perpendicular to the line of fire to insure that virgin vegetation was encountered and that the vegetation was not being destroyed (shot down).

(19) Repeat above steps for firing the next round.

The movement of the gun and velocity screens after each shot depended upon the specific projectile and the vegetation density. The gun and screens were moved two inches every five shots for the 7.62mm M80 ball and the 5.56mm M193 ball projectiles. For the 10.3 grain steel flechette, 23.9 grain steel flechette, 68.2 grain 5.56mm ball, and .17 caliber ball projectiles the gun and screens were moved four inches every four shots.

The vegetation was characterized to determine its density after the 7.62mm M80 ball and the 5.56mm M193 ball shots and again after the 10.3 grain steel flechette, 23.9 grain steel flechette, 68.2 grain 5.56mm ball, and .17 caliber ball shots. The method of characterization and the results are discussed in Section III.

The goal for each projectile was twenty good shots. A good shot was considered to have taken place when the projectile went through all the screens and a velocity could be calculated at each of the three velocity screen locations.

SECTION III

REDUCTION OF DATA

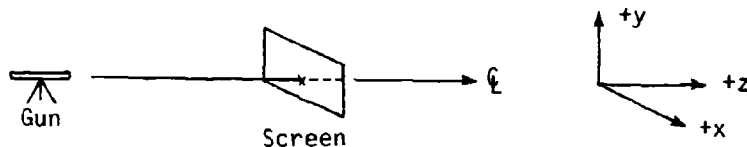
1. VELOCITIES

Velocities for all the projectiles tested are tabulated in Appendix I. The data from each shot is included. Good shots with complete data are listed first; all other shots follow. Notations are made to indicate the reason for incomplete data. Velocities for each set of screens were not always found for even the good shots due to equipment malfunctions. However, a velocity was calculated at each of the three screen locations as discussed in Section II.

All velocities were calculated according to the equations listed in Figures 5 and 7. V_1 through V_4 represent the velocity of the projectile before entering the first section of vegetation, V_5 through V_7 the velocity after leaving the first section and before entering the second section, and V_8 through V_{10} the velocity after leaving the second section. Each velocity is an average which can be assumed to occur midway between the velocity screens used to measure it. For immediate inspection of the data after the shots were made, a computer program was written for the Wang 370 system.

2. DEFLECTIONS

The deflection of the projectiles from the line on which they were fired is tabulated in Appendix II. As in Appendix I, the good shots for each projectile are listed first, followed by all other shots made. The coordinate system used is diagramed below.



The exact position of the gun according to a base coordinate system is given first in the tables. The deflection of the projectile off this center line is shown next. The gun was set at zero (0) in the Z direction. The Z position of the witness screens is listed below.

Shots C through D

1	207.0"
6	657.5"
8	777.5"
9	1086.5"
10	1134.5"
11	1194.5"

Shots E through F

1	18'6"
4	55'6"
5	60'6"
6	64'6"

3. CHARACTERIZATION

After testing projectiles a. through d. the vegetation was characterized to determine its density. It was discovered that so many shots had been made in the test area that the titi was heavily damaged. Because of this, a section of titi directly adjacent to the test area was characterized instead. In addition, certain information concerning the general growth of the titi was obtained.

Characterization was done again after testing projectiles c. through f. In this case it was possible to use the test area itself. The first characterization was done in November while the second was done in March. It is quite possible that differences in titi density could be caused by different seasonal temperatures and humidity.

The general procedure used for characterization was as follows:

- a. Mark off a known area in the vegetation to be characterized.
- b. Cut the vegetation at ground level.
- c. Lay the cut vegetation out in the same orientation that it grew and cut the vegetation at predetermined heights.
- d. Separate the leaves from the stems for a percentage weight comparison.
- e. Weigh all leaves and stems according to height interval.
- f. Calculate the vegetation density from the above weights and respective volumes.
- g. Determine the distribution of stem diameters.
- h. Determine the pattern of vegetation growth by plotting the position of the stem bases.

The results of the characterization are shown in Appendix III.

SECTION IV

CONCLUSIONS

1. VELOCITY

Measuring velocity by means of light screens and Mylar[®] screens proved to be quite satisfactory. As evidenced by the data contained in Appendix I, the screens functioned well and, because two or more measurements were made at each location, accuracy was easy to check. Even though the velocity screens must be shifted after each shot, they do not lengthen the turn-around time since deflection measurements must also be made after each shot and these measurements take longer. Time would be saved, however, by having the capability to calculate velocities automatically as each shot is made.

2. STABILITY

Stability was determined by observing the orientation of holes caused by projectiles passing through the witness panels. Near the completion of the firings, extra witness panels were inserted at 9 and 18 feet into the titi to determine projectile stability. Of 16 shots made with the 10.3 grain flechette, there was no difference in the number of unstable shots between the two locations (7 were stable, 7 were oriented at 45 degrees, and 2 were oriented at 90 degrees). Of 16 shots made with the .17 caliber ball, 7 were stable after 9 feet and 3 were stable after 18 feet; 2 were oriented at 45 degrees after 9 feet and 10 were at 45 degrees after 18 feet; 6 were oriented at 90 degrees after 9 feet and 4 were at 90 degrees after 18 feet.

Data from the other witness panels indicated that the projectiles tumbled or they became unstable. In future testing, insertion of additional witness panels in the titi would be of value in investigating the tumbling and in determining at what point in the vegetation the majority of projectiles of a particular type become unstable.

Stability data is included in Appendix II. In some instances where instability occurred, this data gives coordinates for each end of the projectile. The percentage of instability for each type projectile is shown in Table I.

3. BREAK-UP

Projectile break-up data was determined from the witness panels and is included in Appendix II. The percentage of break-up for each type projectile is shown in Table I.

TABLE I. SUMMARY OF PROJECTILE INSTABILITY, DEFLECTION AND BREAK-UP			
PROJECTILE	PERCENT UNSTABLE	PERCENT DEFLECTED	PERCENT BREAK-UP
7.62 M80 Ball	22.7	11.3	3.7
7.62 M80 Ball	34.6	18.2	1.8
5.56 M193 Ball	42.7	40.0	5.3
5.56 M193 Ball	53.6	35.2	0.0
10.3 Grain Flechette	69.3	11.5	0.0
23.9 Grain Flechette	87.0	8.7	0.0
68.2 Grain 5/56 Ball	74.0	0.0	11.8
.17 Caliber Ball	68.8	0.0	25.0

4. DEFLECTION

Examination of the deflection measurements indicated that there were inherent errors in the method of testing and in the test set-up as follows:

a. The original survey for the reference markers locating the various parts of the system was not as accurate as was needed (± 0.1 foot versus ± 0.1 inch).

b. The wooden rails used to position the gun and screens warped and moved in the ground with changes in the weather.

c. The gun and screens were positioned by eye-alignment on the rails. Since the rails were marked in inches, only a slight error in alignment would be increased greatly after 80 feet.

To improve the accuracy of the data obtained from future tests, the following changes should be made:

- Limit the margin for error in the survey for reference markers to ± 0.1 inch.
- Use steel or aluminum rails anchored in concrete footings for positioning the gun and screens.
- Mount gun and screens on wheels which roll along rails or otherwise render them capable of sliding along the rails so that, after initial alignment, the gun and screens could be moved without changing their orientation.

- Position the gun and screens exactly on the Mann barrel centerline and move them the same distance each time so that deflections could be read directly from the witness panels.

The percentage of deflection for each type projectile is shown in Table I.

APPENDIX I
VELOCITY DATA

7.62 M80 BALL, 2750 FT/SEC., 26.6 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
1	9 Sep	2835.8	2816.9	2826.3	2826.9	2630.2	2616.6	2623.4	2344.5	2356.3	2352.1
2	9 Sep	2867.6	2853.9	2860.7	2855.3	2466.7	2412.9	2439.5	1733.9	1737.6	1735.9
3	9 Sep	2890.5	2875.2	2882.8	2835.4	2728.7	2719.8	2724.2	2140.3	2137.1	2138.5
4	9 Sep	*	2826.5	*	2839.1	2821.7	2797.2	2809.4	2549.1	2571.4	2561.4
5	10 Sep	*	*	*	2804.9	2638.8	2608.4	2623.5	2218.4	2204.6	2210.7
6	10 Sep	*	2754.8	*	2807.2	2301.3	2261.2	2281.1	1701.4	1677.0	1687.7
7	10 Sep	2791.9	2699.8	2745.1	2780.5	2757.4	2727.8	2742.5	2672.9	2682.0	2677.9
8	11 Sep	*	*	*	2755.8	2404.2	2368.0	2386.0	*	1999.8	*
9	11 Sep	*	*	*	2807.2	2513.2	2510.3	2511.7	*	2181.3	*
10	11 Sep	*	*	*	2806.0	2702.3	2710.8	2706.5	*	2554.0	*
11	26 Sep	*	2769.9	*	*	2725.9	2712.5	2719.2	2243.0	2245.3	2244.3
12	26 Sep	2760.1	2774.5	2767.3	2777.8	*	2443.8	*	2219.6	2234.1	2227.7
13	26 Sep	*	2774.4	*	2793.3	2674.5	2657.9	2666.2	2335.4	2327.4	2330.9
14	26 Sep	2827.4	2806.8	2817.1	2820.9	2695.7	2668.8	2682.2	2502.0	2507.3	2504.9
15	2 Oct	2875.5	2861.2	2868.4	2859.2	2726.7	2714.9	2720.8	2416.9	2360.8	2416.6
16	2 Oct	2804.9	2801.6	2803.2	2818.9	2763.5	2764.4	2763.9	2266.5	2257.3	2261.4
17	3 Oct	*	*	*	2795.0	2638.4	2608.2	2623.2	2289.5	2259.5	2272.7
18	3 Oct	2852.7	*	*	2836.9	2638.8	2614.9	2626.8	2443.5	2400.7	2419.5
19	3 Oct	2817.4	2800.6	2808.9	2810.9	*	*	2439.5	1728.8	1696.1	1710.5
20	SHOT #20 FOUND TO BE IN ERROR										

* Equipment Malfunction

7.62 M80 BALL, 2750 FT/SEC., 26.6 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
21	9 Sep	*	2862.1	*	2861.8	2568.9	2533.1	2550.9	**	**	**
22	10 Sep	*	*	*	2800.5	2531.6	2507.9	2519.7	**	**	**
23	10 Sep	2803.8	*	*	2831.1	2064.6	*	*	**	**	**
24	26 Sep	2758.3	2759.1	2758.7	*	2317.9	*	*	*	*	*
25	2 Oct	2815.9	*	*	*	2335.4	*	*	*	*	*
26	2 Oct	2814.2	*	*	2785.5	2716.8	*	*	*	*	*
27	2 Oct	2812.3	2813.4	2812.9	2818.9	2594.2	*	*	*	*	*
28	3 Oct	2838.65	*	*	2816.9	2219.2	*	*	**	**	**
29	3 Oct	*	*	*	2822.0	2567.8	2531.6	2549.6	**	**	**
* Equipment Malfunction ** Projectile Deflected and Missed Screens											

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
1	28 Aug	2831.9	2815.3	2823.6	2831.9	2750.9	2724.6	2737.7	2251.4	2231.1	2240.1
2	28 Aug	2827.4	2813.7	2820.6	2821.5	2795.9	2767.3	2781.6	2300.6	2370.5	2338.9
3	28 Aug	2813.3	*	*	2809.2	2748.5	2723.9	2736.1	1943.8	1939.1	1941.2
4	28 Aug	2836.1	2834.5	2835.3	2823.5	2784.7	2786.1	2785.4	2375.6	2361.9	2367.9
5	28 Aug	2853.2	*	*	2842.9	2803.9	*	*	2456.2	2469.3	2463.5
6	3 Sep	*	2812.1	*	2827.1	2804.3	2768.7	2786.4	1919.5	1880.1	1897.4
7	8 Sep	*	*	*	2837.9	2804.6	2806.9	2805.8	2527.0	2519.3	2522.7
8	8 Sep	*	*	*	2833.3	2814.2	2808.9	2811.6	2686.7	2699.2	2693.6
9	8 Sep	2759.5	2732.2	2745.8	2783.4	*	2766.3	*	2682.2	2714.6	2700.1
10	8 Sep	*	2820.1	*	2832.3	*	2793.9	*	2209.7	2208.5	2209.0
11	13 Sep	2814.2	*	*	2823.9	*	2779.3	*	*	2717.5	*
12	13 Sep	2814.2	*	*	2823.3	*	2770.7	*	2691.9	2662.1	2675.3
13	13 Sep	2821.0	*	*	2822.7	*	2697.9	*	2226.9	2226.9	2244.2
14	14 Oct	2808.2	2781.0	2794.5	2804.1	2717.5	2676.4	2696.8	*	2344.8	*
15	14 Oct	2785.8	2743.5	2764.5	2764.1	2734.0	2726.3	2730.2	*	2457.9	*
16	14 Oct	2801.4	2773.3	2787.3	2799.7	2668.8	2628.9	2648.7	*	2378.7	*
17	14 Oct	2803.3	2757.1	2780.0	2782.2	2742.3	2744.1	2743.2	*	2681.3	*
18	14 Oct	2813.9	2780.9	2797.3	2802.3	2767.2	2754.9	2761.1	2796.6	2678.4	2729.7
19	14 Oct	2781.6	*	*	2774.7	*	*	2574.3	*	2514.3	*
20	14 Oct	2787.2	2739.3	2763.0	2786.5	2677.7	2637.3	2657.3	*	2271.3	*
21	3 Sep	2781.2	2831.3	2805.9	2764.5	2822.3	2788.9	2805.5	*	*	*
22	3 Sep	*	*	*	*	2810.6	2784.7	2797.6	2872.7	*	*
23	3 Sep	2786.3	*	*	*	*	*	*	*	*	*
24	3 Sep	*	*	*	*	*	*	*	*	*	*
25	13 Oct	2801.3	*	*	*	*	*	*	*	*	*

* Equipment Malfunction

7.62 M80 BALL, 1944 FT/SEC., 26.6 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
1	9 Sep	1963.2	1955.4	1959.3	1966.8	1856.2	1838.0	1847.1	1317.0	1313.8	1315.3
2	10 Sep	*	1885.4	*	1889.4	1802.1	*	*	1424.29	1401.1	1411.3
3	10 Sep	1948.9	1947.8	1948.3	1944.9	*	1785.2	*	1505.9	1495.4	1500.0
4	10 Sep	2014.6	2010.5	2012.5	2012.2	1855.7	1836.2	1845.9	1645.0	1634.8	1639.3
5	10 Sep	1860.8	1854.6	1857.7	1856.1	1752.0	1721.9	1736.8	1436.9	1432.5	1434.5
6	10 Sep	2019.6	2016.9	2018.3	2017.3	1865.7	1836.9	1851.2	1574.8	1528.9	1548.9
7	11 Sep	*	*	*	1984.0	*	*	1880.8	*	1639.2	*
8	11 Sep	*	*	*	1957.2	1857.0	1845.8	1851.4	1810.8	*	*
9	11 Sep	*	*	*	2012.5	*	*	1911.0	*	1559.9	*
10	26 Sep	1864.6	1874.8	1869.7	1878.8	1368.3	1343.6	1355.9	1141.2	1151.3	1146.8
11	26 Sep	1795.1	1802.9	1799.0	1809.1	2726.7	*	*	1536.6	1537.8	1533.2
12	26 Sep	1819.3	1824.6	1821.9	1831.5	*	1703.9	1709.7	1496.3	1489.0	1492.2
13	26 Sep	*	1855.6	1853.5	1863.1	1682.4	1651.6	1666.9	1379.0	1375.7	1377.2
14	2 Oct	1947.0	1933.1	1940.1	1937.9	1754.1	1774.2	1764.1	1510.5	1503.9	1506.8
15	2 Oct	1994.0	1983.0	1988.5	1987.1	*	1920.5	*	1759.8	1767.6	1764.1
16	2 Oct	1954.6	1942.1	1948.3	1943.6	*	1908.9	*	1770.5	1774.3	1772.6
17	2 Oct	1955.9	1943.9	1949.8	1946.5	1863.4	1844.5	1853.9	1498.9	1485.8	1491.6
18	3 Oct	1998.8	2007.6	2003.2	2020.2	1439.6	1413.1	1426.2	1101.4	1089.2	1094.6
19	3 Oct	2001.8	2015.7	2008.8	2016.1	1678.7	1640.4	1659.3	1322.1	1316.2	1318.8
20	3 Oct	1989.5	1998.5	1993.9	2000.0	1735.9	1706.5	1721.1	1453.1	1451.7	1452.3
21	3 Oct	1989.7	1996.0	1992.8	1997.0	*	1786.2	*	1475.3	1470.6	1472.7
22	9 Sep	1971.2	1953.1	1962.1	1964.5	1838.4	**	**	**	**	**
23	9 Sep	1953.1	1947.8	1950.5	1955.9	1746.1	1716.2	1731.0	**	**	**
24	10 Sep	1854.8	1871.9	1863.3	1731.2	**	**	**	**	**	**
25	10 Sep	2027.3	2025.1	2026.2	2022.5	1838.2	1807.3	1822.6	**	**	**
* Equipment Malfunction											
** Projectile Deflected and Missed Screens											

7.62 M80 BALL, 1944 FT/SEC., 26.6 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
26	11 Sep	*	*	*	*	*	*	*	*	1726.6	*
27	11 Sep	1987.0	*	*	*	*	*	*	*	1721.2	*
28	11 Sep	*	*	*	1952.9	1783.1	1761.7	1772.4	**	**	**
29	11 Sep	*	*	*	1859.6	**	**	**	**	**	**
30	26 Sep	1959.1	1967.2	1963.1	1972.4	1562.6	1533.6	1550.4	**	**	**
31	2 Oct	1947.0	*	*	1508.3	**	**	**	**	**	**
32	3 Oct	1928.5	1906.7	1917.6	1946.5	**	**	**	**	**	**
* Equipment Malfunction ** Projectile Deflected and Missed Screens											

7.62 M80 BALL, 1944 FT/SEC., 42.1 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
1	2 Sep	1990.8	1987.3	1989.0	1984.1	*	1957.6	*	1850.7	1871.1	1861.9
2	2 Sep	2056.5	2045.8	2051.2	2044.2	1978.3	1959.2	1968.7	1674.9	1698.4	1687.9
3	2 Sep	2057.1	2044.9	2051.0	2040.3	1950.9	1933.5	1942.2	1667.2	1697.2	1683.8
4	2 Sep	2043.8	2030.9	2037.3	2029.7	2007.1	1988.2	1997.6	*	*	1900.1
5	3 Sep	1881.4	*	*	1898.9	*	1821.2	*	*	*	1532.4
6	3 Sep	1882.8	*	*	1872.9	1860.9	1853.3	1857.1	*	*	1662.8
7	4 Sep	1905.5	1918.6	1912.0	1928.3	1903.2	1900.3	1901.8	1655.6	1651.5	1653.3
8	4 Sep	1967.9	1943.3	1955.5	1955.8	1851.2	1820.4	1835.7	1349.5	1339.2	1343.8
9	4 Sep	1954.2	1934.9	1944.5	1945.5	1843.7	1814.7	1829.1	1335.1	1336.2	1335.7
10	4 Sep	1936.9	1949.3	1943.1	1930.4	1904.8	1895.4	1900.1	1601.9	1582.6	1591.1
11	13 Oct	1890.1	*	*	1886.5	*	1757.1	*	*	1534.5	*
12	13 Oct	1888.8	*	*	1898.8	1759.7	1729.6	1744.5	1514.5	1490.8	1501.3
13	13 Oct	1958.8	*	*	1968.6	1906.6	1891.8	1899.2	1791.2	1765.0	1776.6
14	13 Oct	1934.6	*	*	*	*	1899.6	*	1737.4	1716.9	1725.9
15	14 Oct	1894.2	1848.1	1870.8	1875.9	*	*	1851.4	1741.6	1647.9	1688.3
16	14 Oct	1912.4	1858.6	1885.1	1894.6	1870.6	1856.2	1863.4	*	1766.7	*
17	14 Oct	1893.4	1869.1	1881.2	1887.6	1858.1	1856.7	1857.4	*	1804.9	*
18	14 Oct	1900.5	1872.2	1886.2	1892.4	1864.3	1863.9	1864.1	*	1828.0	*
19	14 Oct	1936.6	*	*	1924.6	1841.6	1828.4	1834.9	*	1683.6	*
20	14 Oct	1876.7	1857.2	1866.9	1877.8	1716.9	1702.1	1709.5	*	1576.7	*
21	2 Sep	2016.2	*	*	2009.1	*	**	**	**	**	**
22	13 Oct	1956.3	*	*	*	*	*	*	1651.3	1636.7	1643.1
23	14 Oct	1882.5	*	*	1553.3	*	*	*	*	1736.3	*
* Equipment Malfunction											
** Projectile Deflected and Missed Screens											

5.56 M193 BALL, 3200 FT/SEC., 26.6 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
1	2 Oct	3166.4	*	*	3167.1	1877.4	1810.8	1843.5	1077.4	*	*
2	10 Sep	3135.6	3140.7	3138.1	3154.8	3013.3	*	*	2143.9	*	*
3	10 Sep	3165.4	3152.6	3158.9	3166.6	*	*	3077.8	1638.3	*	*
4	10 Sep	3217.3	3196.9	3207.1	3198.7	2909.7	2868.1	2888.8	2241.6	2178.3	2205.9
5	10 Sep	3237.9	3188.8	3213.2	3222.9	2829.5	*	*	2230.5	2181.0	2202.8
6	10 Sep	3213.2	3190.8	3201.9	3196.4	2756.3	2702.3	2729.0	2062.6	2014.0	2035.3
7	2 Oct	3209.2	*	*	3189.8	2554.0	2502.0	2527.7	2135.3	2105.9	2118.9
8	2 Oct	3239.6	3209.9	3224.7	3225.8	2529.6	2618.9	2573.5	1893.3	1897.7	1895.7
9	2 Oct	3201.2	3181.5	3191.3	3197.4	2850.3	2822.1	2836.2	2120.2	2096.1	2106.7
10	2 Oct	3228.1	3203.5	3215.7	3212.9	2934.1	2880.8	2907.2	2247.7	2214.4	2229.1
11	8 Oct	3201.2	*	*	3218.0	2414.9	2371.9	2393.2	1555.5	1521.4	1536.4
12	8 Oct	3221.2	3211.7	3216.5	3220.6	*	2493.4	*	2074.4	2033.8	2051.7
13	8 Oct	3235.2	3219.4	3227.3	3225.8	2651.1	2599.8	2625.2	2159.7	2140.4	2148.9
14	8 Oct	3210.5	3192.4	3201.4	3200.0	2382.2	2328.8	2355.2	1844.1	1788.3	1812.7
15	8 Oct	3228.1	3204.9	3216.5	3215.4	2744.1	2687.0	2715.3	2188.2	2167.6	2176.7
16	8 Oct	3223.9	3196.1	3209.9	3200.0	2915.9	2882.7	2899.2	2218.8	2192.9	2204.4
17	9 Oct	3172.6	3139.5	3155.9	3162.1	2172.5	2125.8	2148.9	1577.1	1551.3	1562.6
18	9 Oct	3178.6	3160.6	3169.6	3182.2	*	2488.1	*	1995.4	1960.1	1975.6
19	9 Oct	3160.9	3162.4	3161.7	3182.2	2303.6	2240.2	2271.5	1468.3	*	*
20	SHOT #20 FOUND TO BE IN ERROR										

* Equipment Malfunction

5.56 M193 BALL, 3200 FT/SEC., 26.6 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
21	10 Sep	3150.8	3158.6	3154.7	*	*	*	*	*	**	**
22	10 Sep	3182.1	3184.7	3183.4	3201.0	2805.5	2749.1	2777.0	**	**	**
23	10 Sep	3217.3	*	*	3175.4	2209.7	*	*	**	**	**
24	10 Sep	3187.8	3156.6	3172.1	3174.9	2469.6	2425.8	2447.5	**	**	**
25	2 Oct	*	*	*	*	**	**	**	**	**	**
26	2 Oct	3225.6	*	*	3187.3	1849.6	*	*	**	**	**
27	2 Oct	3190.2	*	*	3174.6	2355.8	*	*	**	**	**
28	2 Oct	3203.9	*	*	*	2226.9	*	*	**	**	**
29	2 Oct	3156.6	3197.8	3177.0	*	*	*	2150.2	**	**	**
30	3 Oct	3224.8	*	*	*	2241.9	*	*	**	**	**
31	3 Oct	3213.6	3196.3	3204.9	3179.7	2587.2	*	*	**	**	**
32	3 Oct	3184.3	3171.2	3177.7	3177.1	2828.1	*	*	**	**	**
33	3 Oct	3186.1	3185.7	3185.9	3189.8	**	**	**	**	**	**
34	8 Oct	2829.8	2822.3	2826.1	2836.9	2285.6	*	*	**	**	**
35	8 Oct	3198.9	3169.2	3184.0	3182.2	2645.1	*	*	**	**	**
36	8 Oct	3203.7	*	*	3179.7	2592.7	*	*	2337.1	**	**
37	8 Oct	3215.2	*	*	2989.5	*	*	*	2308.3	2308.3	2321.0
38	9 Oct	3180.1	*	*	3189.8	*	*	*	**	**	**
39	9 Oct	3263.3	3231.9	3247.5	3233.6	**	*8	**	**	**	**
40	9 Oct	3120.5	*	*	*	2152.4	*	*	**	**	**
41	9 Oct	3163.6	3161.9	3162.8	3179.7	**	**	**	**	**	**

* Equipment malfunction
 ** Projectile Deflected and Missed Screens

5.56 M193 BALL, 3200 FT/SEC., 42.1 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
1	28 Aug	3223.5	3205.1	3214.3	3210.0	3143.1	3130.3	3136.7	2086.0	1973.8	2022.2
2	28 Aug	3252.2	3219.6	3235.8	3221.6	*	3170.9	*	2519.2	2524.2	2521.9
3	28 Aug	3254.1	3232.1	3243.1	3228.9	3008.8	2947.6	2977.9	2570.0	2584.9	2578.3
4	2 Sep	3234.6	3186.7	3210.5	3206.2	2901.6	2841.1	2871.0	*	*	2334.8
5	2 Sep	3259.2	3211.3	3235.1	3234.7	3004.6	*	*	*	*	2486.6
6	3 Sep	3000.8	3182.7	3089.1	3197.2	3085.5	3050.6	3067.9	2642.0	2614.1	2626.4
7	4 Sep	3233.7	3196.9	3215.2	3218.0	3047.5	3018.4	3032.9	2751.8	2771.5	2762.7
8	8 Sep	3224.1	3188.8	3206.4	3217.2	2919.9	2861.4	2890.3	3266.0	2354.9	2359.9
9	8 Sep	3258.4	3236.2	3247.3	3245.9	3088.9	3047.5	3068.0	2528.9	2510.7	2518.8
10	8 Sep	3231.9	3198.9	3215.3	3217.2	3108.5	*	*	3263.9	2319.8	2339.2
11	14 Oct	3156.8	3132.4	3144.6	3148.6	*	3064.3	*	2928.7	2847.7	2883.1
12	14 Oct	3143.5	3111.4	3127.3	3141.4	*	3048.0	*	2966.0	2917.8	2939.1
13	14 Oct	3242.5	3153.9	3197.6	3199.2	*	*	3109.9	*	2981.9	*
14	14 Oct	3185.7	3135.9	3160.7	3170.1	2928.1	2884.5	2906.1	*	2417.1	*
15	16 Oct	3103.5	3079.2	3091.3	3102.9	2523.6	*	*	1389.5	*	*
16	16 Oct	3134.2	3110.8	3122.5	3138.7	3050.3	*	*	2613.9	2538.3	2571.4
17	16 Oct	3121.1	*	*	3134.1	2799.2	2749.4	2774.1	1965.4	1898.7	1927.8
18	16 Oct	3103.5	3089.3	3096.4	3108.2	2571.2	2529.9	2550.4	2177.9	*	*
19	SHOTS 19 & 20 FOUND TO BE IN ERROR										
20	28 Aug	3240.2	3211.3	3225.7	3228.4	2802.8	*	*	**	**	**
21	28 Aug	3198.9	3242.5	3220.6	3182.4	2954.9	2899.6	2926.9	**	**	**
22	3 Sep	3029.0	2873.6	2949.2	3171.8	3090.4	3035.1	3062.5	1415.6	1257.9	1323.4
23	4 Sep	3195.1	3154.6	3174.7	3143.7	3006.4	2964.0	2985.1	1666.0	1956.0	1815.6
24	4 Sep	2283.7	*	*	*	2198.4	2166.8	2182.5	1879.8	1870.8	1874.6
25											

* Equipment Malfunction
 ** Projectile Deflected and Missed Screens

5.56 M193 BALL, 3200 FT/SEC., 42.1 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
26	8 Sep	3258.2	3223.7	3240.9	3199.7	2691.7	*	*	**	**	**
27	8 Sep	3254.4	3211.3	3232.7	3234.4	2932.6	2867.6	2899.7	**	**	**
28	8 Sep	3244.9	3207.2	3225.9	3224.5	3052.7	2884.2	2966.0	**	**	**
29	14 Oct	*	2734.0	*	*	*	*	*	*	*	*
30	14 Oct	3198.8	*	*	*	*	*	*	*	2696.7	*
31	14 Oct	3169.9	*	*	*	*	*	*	*	2631.6	*
32	14 Oct	3254.2	3156.9	3204.8	3213.1	2811.5	*	*	**	**	**
33	14 Oct	3219.9	3140.1	3179.6	3184.2	2769.6	*	*	**	**	**
34	16 Oct	3093.7	3091.8	3092.7	3094.5	*	*	*	**	**	**
35	16 Oct	3132.2	3157.6	3144.9	3150.9	*	*	*	*	2663.1	*
36	16 Oct	3160.2	*	*	*	*	*	*	*	**	**
37	16 Oct	3108.7	3350.5	3225.1	2998.1	*	*	*	**	**	**
* Equipment Malfunction											
** Projectile Deflected and Missed Screens											

5.56 M193 BALL, 2300 FT/SEC., 26.6 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
1	10 Sep	2425.2	2430.7	2427.9	2441.3	2168.6	*	*	1661.9	1633.0	1645.7
2	10 Sep	2289.7	2385.5	2336.6	2398.7	2133.3	2087.2	2109.9	1425.7	1386.0	1403.4
3	2 Oct	2375.3	*	*	2385.2	2074.5	2033.3	2053.7	1675.2	1661.6	1667.6
4	10 Sep	2387.3	*	*	2406.2	1991.6	*	*	1665.0	1654.2	1658.9
5	10 Sep	2323.2	2329.9	2326.6	2338.4	*	*	2098.8	1686.9	1665.9	1675.2
6	3 Oct	2400.0	2400.4	2400.2	2411.1	1562.6	1522.7	1542.4	1235.2	1210.3	1221.2
7	11 Sep	2409.2	2385.5	2397.3	2396.4	2124.5	2100.9	2112.6	*	1596.7	*
8	3 Oct	2256.3	2253.7	2254.9	2266.3	1753.8	1723.2	1738.4	1312.4	*	*
9	3 Oct	2302.9	2303.6	2303.3	2316.2	2065.2	2013.0	2038.8	1464.1	1453.7	1458.3
10	8 Oct	2315.2	2243.3	2278.7	2276.6	1560.3	1528.4	1544.2	1079.2	*	*
11	8 Oct	2370.3	*	*	2339.2	*	1991.3	*	1635.1	1610.0	1621.1
12	8 Oct	2339.4	2295.3	2317.1	*	2111.8	*	*	1786.0	1761.9	1772.5
13	8 Oct	2407.2	2393.3	2400.2	2396.6	*	1692.4	*	1336.4	1303.6	1317.9
14	8 Oct	2348.3	2328.1	2338.1	2335.1	*	1738.2	*	1391.5	1356.3	1371.7
15	8 Oct	2331.3	2314.8	2323.0	2321.5	*	1725.6	*	1431.1	1410.0	1419.3
16	9 Oct	2361.7	2343.8	2352.7	2355.7	1908.7	1866.1	1887.1	1463.9	1436.4	1448.5
17	9 Oct	2430.9	2411.0	2420.9	2433.1	2084.5	2040.6	2062.3	1620.9	1580.8	1598.4
18	9 Oct	2350.3	2308.4	2329.2	2336.7	2074.2	2026.9	2050.3	1554.8	1525.1	1538.2
19	SHOTS # 19 & 20 FOUND TO BE IN ERROR										
20											
21	10 Sep	2331.8	*	*	2256.4	*	*	*	1935.3	1902.9	1917.2
22	11 Sep	2517.8	2522.7	2520.2	*	1695.5	1432.9	1553.2	**	**	**
23	11 Sep	2376.7	2325.3	2375.9	2383.4	1869.7	**	**	**	**	**
24	11 Sep	2494.8	2505.0	2499.9	2513.2	*	*	*	*	*	*
25	11 Sep	2316.8	2323.4	2320.1	2336.9	1650.9	*	*	**	**	**
* Equipment Malfunction											
** Projectile Deflected and Missed Screens											

5.56 M193 BALL, 2300 FT/SEC., 26.6 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
26	2 Oct	2393.8	*	*	*	*	*	*	*	1207.6	*
27	2 Oct	2503.9	*	*	*	*	*	*	1950.7	1942.7	1946.3
28	2 Oct	2343.7	2323.1	2333.5	2333.7	1799.7	1319.9	1522.9	**	**	**
29	3 Oct	2395.8	2400.4	2398.1	2412.6	*	*	*	**	**	**
30	3 Oct	2424.0	*	*	*	*	*	*	1354.4	1324.4	1337.6
31	3 Oct	*	*	*	2715.6	1354.4	*	*	**	**	**
32	3 Oct	2431.3	2374.9	2402.8	*	*	*	*	**	**	**
33	3 Oct	2393.0	2294.3	2342.6	*	*	*	*	**	**	**
34	3 Oct	2389.3	2325.5	2356.9	2357.1	1507.9	1190.1	1330.3	**	**	**
35	3 Oct	2421.3	2366.1	2393.4	2385.2	1466.6	1137.1	1281.0	**	**	**
36	8 Oct	2299.3	2240.4	2269.5	2280.5	1974.5	*	*	**	**	**
37	8 Oct	2443.1	*	*	*	*	*	*	*	*	*
38	8 Oct	*	2431.7	*	2439.0	1578.6	*	*	**	**	**
39	9 Oct	2329.9	2312.9	2321.4	2325.6	**	**	**	**	**	**
40	9 Oct	2251.1	*	*	*	*	*	*	**	**	**
41	9 Oct	2329.1	2303.5	2316.2	*	**	**	**	**	**	**
42	9 Oct	2361.4	2329.3	2345.3	*	*	*	*	**	**	**

* Equipment Malfunction
 ** Projectile Deflected and Missed Screens

5.56 M193 BALL, 2300 FT/SEC., 42.1 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
1	8 Sep	2385.6	2367.4	2376.5	2378.1	2274.3	2238.0	2256.0	*	*	1500.4
2	2 Sep	2551.8	2520.2	2535.9	2544.4	*	2465.6	*	*	*	2075.4
3	2 Sep	2422.5	2388.9	2405.6	2404.9	2107.9	*	*	*	*	1601.1
4	2 Sep	2610.4	2581.3	2595.9	2592.7	2434.2	2395.6	2414.7	*	*	1552.7
5	8 Sep	2393.9	2377.6	2385.7	2389.3	2127.3	2080.3	2103.5	1679.3	1640.3	1657.4
6	3 Sep	2352.9	2332.1	2342.5	2343.9	2253.9	*	*	*	*	2046.8
7	3 Sep	2341.4	2315.9	2328.6	2333.0	2165.9	2134.5	2150.1	*	*	1967.7
8	4 Sep	2399.8	2374.2	2386.9	2383.9	2015.3	*	*	1485.4	1476.8	1480.6
9	4 Sep	2271.4	2299.9	2285.6	2306.9	2064.5	2017.5	2040.7	1697.6	1703.1	1700.6
10	4 Sep	2414.9	2388.9	2401.8	2406.0	2339.3	2323.2	2331.2	2169.4	2190.5	2181.1
11	14 Oct	2295.5	*	*	2289.1	1903.5	*	*	1736.1	1685.5	1707.7
12	14 Oct	2301.2	2274.9	2287.9	2285.6	2142.9	2108.0	2125.4	1620.5	1576.7	1595.9
13	14 Oct	2328.5	2299.8	2314.1	2319.6	*	2038.2	*	1749.9	1629.5	1680.9
14	14 Oct	2311.2	2289.2	2300.1	2304.7	2088.9	2054.6	2071.6	1791.8	1681.2	1728.6
15	14 Oct	2396.8	2324.7	2360.2	2367.6	2052.4	2012.2	2032.1	2028.3	1234.4	1494.3
16	14 Oct	2362.8	2331.5	2347.1	2342.1	*	2257.1	*	*	1833.4	*
17	14 Oct	2390.9	2346.3	2368.4	2363.9	2262.5	2262.9	2262.8	*	2009.0	*
18	16 Oct	2472.4	*	*	*	*	*	1789.8	1337.3	1320.6	1327.9
19	16 Oct	2347.5	2347.1	2347.3	2355.9	2044.5	2007.5	2025.8	1465.8	1452.3	1458.3
20	16 Oct	2462.7	2413.0	2437.6	2451.7	*	*	2040.8	1741.9	1691.1	1713.3
21	2 Sep	2456.5	2430.7	2443.5	*	*	2274.9	*	*	*	*
22	2 Sep	2352.3	2324.5	2338.3	2338.8	1863.5	1823.8	1843.4	**	**	**
23	3 Sep	2341.4	2315.9	2328.6	2279.9	2165.9	*	*	*	*	1967.7
24	4 Sep	2476.9	2533.4	2545.1	2544.6	1965.0	1916.1	2020.2	*	*	*
25	14 Oct	2296.9	*	*	2282.6	*	*	*	**	**	**

* Equipment Malfunction

** Projectile Deflected and Missed Screens

5.56 M193 BALL, 2300 FT/SEC., 42.1 INCHES

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇	V ₈	V ₉	V ₁₀
26	14 Oct	2357.3	2332.5	2344.8	2342.7	*	*	*	**	**	**
27	14 Oct	1984.9	1957.8	1971.3	1963.9	1702.5	*	*	**	**	**
28	16 Oct	2367.4	*	*	2380.8	1846.7	*	*	**	**	**
29	16 Oct	2349.2	2344.2	2346.7	2353.4	**	**	**	**	**	**
30	16 Oct	2373.3	2366.6	2369.9	*	**	**	**	**	**	**
31	16 Oct	2289.4	2283.8	2286.6	2275.6	*	*	*	**	**	**
* Equipment Malfunction ** Projectile Deflected and Missed Screens											

23.9 GRAIN FLECHETTE

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇
1	2 Feb	4214.9	4181.2	4194.6	4194.9	3507.0	3418.8	3467.3
2	2 Feb	4013.2	4006.7	4009.3	*	2168.9	2128.2	2150.6
3	2 Feb	4202.6	4195.8	4198.5	4197.8	3302.1	3247.0	3277.4
4	4 Feb	3817.2	3795.5	3804.2	3803.4	3749.3	3746.7	3748.1
5	4 Feb	4128.4	4110.7	4117.8	4117.1	4043.0	4077.9	4058.4
6	4 Feb	4325.7	4248.1	4278.8	4377.1	4246.3	4258.0	4251.5
7	4 Feb	4054.3	3996.3	4019.3	4234.9	4047.9	4048.9	4048.4
8	5 Feb	4198.2	4165.8	4178.7	*	3209.9	3170.1	3192.1
9	5 Feb	4256.7	4220.9	4235.1	4235.1	3232.7	3127.2	3184.9
10	5 Feb	4030.2	3997.1	4010.3	4010.4	3758.6	3861.4	3803.6
11	5 Feb	4191.9	4150.8	4167.2	4167.0	3580.4	3463.8	3527.6
12	5 Feb	*	4205.8	*	*	2972.3	*	*
13	5 Feb	4500.5	4188.2	4307.7	4307.9	1855.6	*	*
14	5 Feb	4104.7	4158.6	4136.8	4136.8	2905.3	2745.7	2832.1
15	5 Feb	4484.3	4125.1	4261.7	4261.5	2390.1	2297.4	2347.9
16	5 Feb	*	4001.6	*	*	3520.6	3387.5	3460.2
17	5 Feb	*	3995.7	*	*	2478.9	*	*
18	5 Feb	*	4218.5	*	*	3194.5	3120.9	3161.3
19	5 Feb	*	4182.9	*	*	4184.2	4224.2	4201.9
20	5 Feb	*	4135.6	*	*	4140.1	4170.1	4153.4
21	2 Feb	4013.2	4006.7	4009.3	*	**	**	**
22	2 Feb	4129.2	4119.7	4123.5	*	*	*	*
23	5 Feb	4210.5	4210.5	**	**	**	**	**

* Equipment Malfunction

** Projectile Deflected and Missed Screens

10.3 GRAIN FLECHETTE

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇
1	17 Feb	4703.7	*	*	*	4514.7	*	*
2	17 Feb	4781.3	*	*	*	4667.2	*	*
3	17 Feb	4551.1	*	*	*	3020.4	*	*
4	17 Feb	4645.8	*	*	*	2905.5	*	*
5	17 Feb	4743.3	*	*	*	3947.3	*	*
6	18 Feb	4480.8	4467.3	4472.7	4472.5	3426.1	*	*
7	18 Feb	4772.1	4763.0	4766.7	4766.7	4545.5	4561.0	4552.4
8	18 Feb	4773.3	4767.9	4770.1	4770.1	4409.6	*	*
9	18 Feb	4786.9	4724.4	4749.2	4749.7	3413.7	*	*
10	18 Feb	4775.5	4753.9	4762.6	4762.6	4305.5	*	*
11	18 Feb	*	4845.4	*	*	4517.5	*	*
12	18 Feb	4801.9	4786.6	4792.7	4792.3	4718.3	*	*
13	18 Feb	*	4727.4	*	*	4737.1	*	*
14	18 Feb	4799.0	4768.7	4780.8	4780.8	4551.2	*	*
15	18 Feb	4722.6	4696.7	4706.9	4706.9	3146.2	*	*
16	18 Feb	4599.8	4803.1	4719.7	4720.3	3929.9	*	*
17	18 Feb	4735.9	4738.9	4737.8	4737.3	4686.9	*	*
18	18 Feb	4816.4	4821.6	4819.5	4819.5	3719.1	*	*
19	19 Feb	4506.0	4485.6	4493.8	4493.9	4320.8	*	*
20	19 Feb	4739.9	4717.4	4726.3	4726.3	3874.5	*	*
21	17 Feb	4416.9	*	*	4363.6	**	**	**
22	17 Feb	4608.8	*	*	*	**	**	**
23	17 Feb	*	*	*	*	*	*	*
24	18 Feb	4904.9	4747.2	4809.1	4808.8	**	**	**
25	18 Feb	*	*	*	4777.1	*	*	*
26	17 Feb	4728.1	4682.0	4700.4	4702.3	2799.4	*	*

*Equipment Malfunction
 **Projectile Deflected and Missed Screens

68.2 GRAINS, 5.56 BALL

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇
1	9 Feb	2867.2	2857.4	2861.3	2861.3	2614.1	2637.1	2624.3
2	9 Feb	2982.6	2951.2	2963.7	2963.7	2672.7	2636.6	2656.5
3	9 Feb	3006.2	2966.3	2982.1	2982.1	2891.7	2910.4	2899.9
4	9 Feb	2931.5	*	*	2931.2	2882.8	2905.5	2892.9
5	9 Feb	2922.5	2915.2	2918.1	*	2456.0	2466.2	2460.6
6	9 Feb	2938.6	2939.4	2939.1	*	2492.8	2460.5	2478.3
7	9 Feb	2851.6	2839.6	2844.4	2844.3	2257.0	*	*
8	9 Feb	2934.5	2922.1	2927.1	*	2368.1	*	*
9	9 Feb	2935.9	2922.4	2927.8	*	2398.8	*	*
10	9 Feb	2964.5	2950.7	2956.2	2956.1	2101.4	*	*
11	9 Feb	2937.3	2930.8	2933.4	*	1859.7	*	*
12	9 Feb	2870.7	2875.8	2873.7	*	2803.9	*	*
13	9 Feb	2980.2	2973.5	2976.2	*	2770.1	*	*
14	9 Feb	2948.3	2924.9	2934.3	*	2660.3	*	*
15	10 Feb	2882.7	2083.4	2343.3	2343.3	2414.5	*	*
16	10 Feb	2973.1	*	*	*	2809.8	*	*
17	10 Feb	2922.5	*	*	*	2769.5	*	*
18	10 Feb	2944.2	*	*	*	2598.2	*	*
19	10 Feb	2980.4	*	*	*	2625.8	*	*
20	10 Feb	2966.3	*	*	*	2516.1	*	*
21	9 Feb	*	*	*	*	*	*	*
22	9 Feb	2988.6	*	*	*	*	*	*
23	10 Feb	*	*	*	*	*	*	*
* Equipment Malfunction								

17 CALIBER BALL

SHOT	DATE	V ₁	V ₂	V ₃	V ₄	V ₅	V ₆	V ₇
1	19 Feb	3849.9	3834.4	3840.5	3841.3	3840.5	*	*
2	19 Feb	3916.6	3898.6	3905.8	3905.6	3651.8	*	*
3	19 Feb	3929.3	3907.5	3916.2	3916.5	3297.9	*	*
4	19 Feb	*	3821.4	*	*	3282.1	*	*
5	19 Feb	3292.9	3847.6	3865.6	3865.6	3332.4	*	*
6	19 Feb	3931.2	3917.7	3923.1	3923.3	2509.0	*	*
7	19 Feb	3943.6	3922.3	3930.8	3931.3	2848.0	*	*
8	19 Feb	3928.5	3916.2	3921.1	3923.7	3205.9	*	*
9	19 Feb	3924.6	3911.9	3916.9	3917.7	2846.2	*	*
10	19 Feb	3921.9	3906.3	3912.5	3912.8	3222.9	*	*
11	19 Feb	3891.1	3872.2	3879.7	3879.7	2668.8	*	*
12	19 Feb	3926.2	3903.5	3912.5	3913.3	2109.5	*	*
13	19 Feb	4000.4	3977.9	3986.9	3986.8	1307.6	*	*
14	19 Feb	3986.0	3971.4	3977.3	3976.9	*	*	*
15	19 Feb	3923.1	3901.7	3910.2	3910.5	2682.8	*	*
16	19 Feb	*	*	*	*	*	*	*
* Equipment Malfunction								

APPENDIX II
DEFLECTION DATA

7.62 M80 BALL, 2750 FT/SEC., 26.6 INCHES

SHOT DATE COORDINATES SCREEN LOCATION GUN	1 ² 9 Sep		2 9 Sep		3 9 Sep		4 9 Sep	
	X	Y	X	Y	X	Y	X	Y
GUN	220.0	26.6	220.0	26.6	220.0	26.6	220.0	26.6
1	- .8	+ 7.4	- .8	+ 8.1	- .8	+ 7.9	- .8	+ 8.1
6	- 6.2	+ 6.1	- 6.3	+ 5.0	- 6.3	+ 5.0	- 5.7	+ 5.7
8	- 3.2	+ 4.7	- 9.9	+ 2.6	- 8.3	+ 4.5	- 5.2	+ 3.2
	- 3.5	+ 4.2						
9	- 8.0	+ 5.2	-27.8	+ 2.0	-13.0	+13.7	- 8.1	+ 1.8
10	- 6.5	+ 5.7	-30.5	+ 1.2	-13.5	+17.8	- 7.1	+ .6
11	- 5.3	+ 5.5	-34.6	+ .5	-15.1	+19.6	- 7.3	- 1.5

SHOT DATE GUN	6 10 Sep		7 10 Sep		8 ² 10 Sep		9 11 Sep	
	X	Y	X	Y	X	Y	X	Y
GUN	228.0	26.6	228.0	26.6	228.0	26.6	236.0	26.6
1	+ .3	+10.7	+ .3	+10.8	+ .3	+10.7	+ 1.4	+10.7
6	- 3.2	+10.5	+ 1.3	+ 2.1	- 2.4	+11.0	- 1.2	+11.3
8	- 5.1	+ 8.5	+ 4.4	- 3.0	- 2.1	+ 9.2	- .3	+11.9
9	-13.4	+10.0	+ 6.1	- 1.5	- 5.0	+ 9.5	- 6.8	+21.2
10	-13.2	+ 9.8	+ 7.5	- 1.5	- 4.9	+10.1	- 6.8	+22.5
							- 7.8	+22.0
11	-13.4	+ 8.5	+ 8.5	- 1.7	- 5.4	+ 9.0	- 8.3	+22.7

SHOT DATE GUN	9 11 Sep		10 11 Sep		11 26 Sep		12 26 Sep	
	X	Y	X	Y	X	Y	X	Y
GUN	236.0	26.6	236.0	26.6	240.0	26.6	240.0	26.6
1	+ 1.2	+10.6	+ .8	+10.6	+ .8	+ 9.9	+ .8	+ 9.9
6	- .8	+12.8	- 1.5	+10.5	- .6	+ 9.3	+ 2.3	+10.2
8	+ .3	+13.2	- .2	+10.5	+ 1.3	+ 6.8	+ 3.7	+ 7.2
9	+ 3.0	23.1	- .8	+13.8	- 6.1	- .2	+ 1.7	+14.3
10	+ 4.3	+24.5	- .1	+13.6	- 7.3	- 1.8	+ 2.6	+15.5
11	+ 5.8	+25.4	- .3	+12.5	- 7.3	- 4.5	+ 3.6	+16.0

SHOT DATE GUN	13 26 Sep		14 26 Sep		15 2 Oct		16 2 Oct	
	X	Y	X	Y	X	Y	X	Y
GUN	240.0	26.6	240.0	26.6	250.0	26.6	250.0	26.6
1	+ .3	+ 9.9	+ .6	+ 9.9	- .2	+ 8.7	+ .3	+ 7.8
6	- .9	+ 8.2	- .9	+ 7.8	- .1	+ 7.3	- 1.4	+ 5.6
8	+ 2.0	+ 5.4	- .8	+ 5.6	+ .3	+ 5.2	- 2.3	+ 3.3
9	- 8.0	+ 3.8	- 1.3	+ 8.7	+ 4.2	+ 1.0	+ 6.4	- 3.9
10	- 9.3	+ 3.0	- .4	+ 8.3	+ 4.2	+ .1	- 1.5	- 4.8
11	-11.1	+ 1.0	+ .6	+ 6.9	+ 4.1	- 2.6	+ .5	- 7.5

SHOT DATE GUN	17 3 Oct		18 3 Oct		19 3 Oct		20	
	X	Y	X	Y	X	Y	X	Y
GUN	256.0	26.6	256.0	26.6	256.0	26.6		
1	+ 2.0	+ 9.2	+ .6	+ 8.6	+ .3	+ 8.5		
6	+ 9.1	+ 6.2	+ 2.9	+ 9.8	+ 3.6	+ 7.4		
8	+10.8	+ 4.5	+13.1	+11.7	+ 1.9	+ 4.1		
9	+18.0	- 3.2	+ 7.9	+18.7	- 7.9	- 5.0		
10	+18.1	- 4.2	+ 9.0	+18.8	- 9.6	- 7.3		
11	+20.2	- 7.0	+ 9.7	+17.5	-12.0	-12.0		

1. Projectile Breakup 2. Unstable

7.62 M80 BALL, 2750 FT/SEC, 26.6 INCHES

SHOT DATE COORDINATES SCREEN LOCATION GUN	21 ¹ 9 Sep		22 ² 10 Sep		23 ² 10 Sep	
	X	Y	X	Y	X	Y
1	220.0	26.6	228.0	26.6	228.0	26.6
6	- .8	+8.1	+ .9	+11.7	+ .5	+11.0
8	- 1.4	+5.7	+ 1.4	+13.5	+ .3	- .6
9	+ 1.8	+2.1	+ 6.8	+11.0		
10						
11						

SHOT DATE GUN	24 ² 26 Sep		25 2 Oct		26 2 Oct	
	1	240.0	26.6	250.0	26.6	250.0
6	+ .6	+9.9	- 2.2	+8.6	- .9	+8.6
8	+ 3.6	+6.9	+32.1	+4.2	-29.8	+5.3
9			+37.9	-1.0	-28.8	+1.8
10			+14.4	+7.7	-10.7	-7.5
11			+12.0	+7.2	- 9.4	-9.0
			+ 8.9	+2.4	- 7.0	-13.5

SHOT DATE GUN	27 2 Oct		28 ² 3 Oct		28 ²	
	1	250.0	26.6	256.0	26.6	256.0
6	- .9	+8.2	+ .3	+8.5	+ 2.3	+8.4
8	+31.2	+6.2	+29.7	+10.0	+ 7.6	+3.8
9	+33.7	+5.1	+23.4	+12.9	+ 6.4	- .6
10	+23.4	-2.3			+ 5.2	-14.0
11	+24.5	+1.5				
	+ 7.9	-5.6				

1. Projectile Breakup

2. Unstable

7.62 M80 BALL, 2750 FT/SEC, 42.1 INCHES

SHOT DATE COORDINATES	12		22		3		42		51	
	28 Aug		28 Aug		28 Aug		28 Aug		28 Aug	
	X	Y	X	Y	X	Y	X	Y	X	Y
SCREEN LOCATION										
GUN	218.0	42.1	218.0	42.1	218.0	42.1	218.0	42.1	218.0	42.1
1	+1.4	+7.9	+1.3	+7.8	+1.3	+8.9	+9	+7.9	+9	+7.9
6	+2.2	+7.8	+1.1	+6.5	+7	+11.3	-7	+7.8	+3	+9.0
8	+1.3	+14.4	-.2	+3.8	+2	+9.7	-2.3	+4.5	-1.3	+6.9
9	+4.9	+8.9	-15.9	+4.1	-2.8	+8.1	-1	+13.2	-1.0	+9.9
	+5.4	+8.0					-1	+13.2	+1.1	+8.6
10	+4.7	+10.7	-19.3	+4.6	-3.8	+8.2	+3.5	+16.2	+6	+10.5
			-18.4	+4.2			+2.4	+16.0	+1.7	+10.2
11	+6.7	+13.4	-26.5	+3.6	-7.8	+7.4	+4.2	+18.6	+2	+10.8
	+7.6	+12.4					+4.1	+18.4	+4	+9.6

SHOT DATE COORDINATES	6		72		8		9		10	
	3 Sep		8 Sep		8 Sep		8 Sep		8 Sep	
	X	Y	X	Y	X	Y	X	Y	X	Y
GUN	230.0	42.1	240.0	42.1	240.0	42.1	240.0	42.1	240.0	42.1
1	+2.6	+8.9	+3.6	+9.6	+3.3	+9.6	+3.6	+9.6	+3.6	+9.6
6	+4.6	+8.5	+5.3	+6.9	+5.1	+6.8	+5.0	+6.9	+5.0	+6.5
8	+4.8	+6.9	+5.3	+5.6	+5.2	+5.2	+4.9	+5.4	+5.2	+4.5
9	+18.6	+2.0	+6.0	+4.2	+4.2	+6.6	+5.5	+5.2	+14.2	+6.5
10	+25.1	-3.9	+5.1	+4.1	+4.2	+7.3	+5.5	+5.5	+16.9	+7.8
11	+31.7	-12.0	+4.9	+3.5	+4.7	+6.4	+5.6	+4.2	+20.2	+7.9
			+4.1	+1.8						

SHOT DATE COORDINATES	11		12		13		14		15	
	13 Sep		13 Sep		13 Sep		14 Oct		14 Oct	
	X	Y	X	Y	X	Y	X	Y	X	Y
GUN	274.0	42.1	274.0	42.1	274.0	42.1	282.0	42.1	282.0	42.1
1	-1.7	+10.4	-2.0	+10.4	-2.0	+10.4	-2.2	+9.2	-2.3	+9.6
6	+2.0	+7.1	+.8	+6.8	+.2	+7.4	+1.6	+7.4	+2.5	+7.9
8	+3.1	+4.2	+1.4	+4.2	+.9	+6.1	+2.2	+6.4	+5.1	+5.2
9	+3.6	+4.6	+1.4	+3.3	+1.2	+3.7	-14.4	+11.9	+6.2	+.7
10	+4.1	+4.4	+1.2	+2.9	+.5	+2.5	+5.6	+12.2	+6.3	-.3
11	+3.9	+1.1	+.3	-.8	-1.4		-1.8	+5.4	+9.4	-4.7

SHOT DATE COORDINATES	16		17		18		19		20	
	14 Oct		14 Oct		14 Oct		14 Oct		14 Oct	
	X	Y	X	Y	X	Y	X	Y	X	Y
GUN	282.0	42.1	282.0	4	282.0	42.1	290.0	42.1	290.0	42.1
1	-2.4	+9.1	-2.1	+9.2	-2.2	+9.1	-1.1	+7.3	-1.6	+8.6
6	+1.2	+7.1	+1.7	+6.8	+3.1	+7.3	+6.9	+8.1	+6.4	+6.5
8	-1.7	+5.5	+2.0	+4.1	+1.7	+5.4	+9.6	+6.0	+9.2	+4.9
9	+3.6	+9.4	+2.9	+.8	+3.6	+5.3	+9.1	+7.2	+11.6	+3.4
10	+4.9	+9.6	+3.3	+4.7	+3.7	+5.7	+9.1	+7.9	+12.4	+2.5
11	+5.3	+6.6	+2.9	+1.6	+4.1	+3.1	+8.4	+6.0	+11.9	-1.5

1. Projectile Breakup

2. Unstable

7.62 M80 BALL, 2750 FT/SEC, 42.1 INCHES

SHOT	21		22		23 ²	
DATE	3 Sep		3 Sep		3 Sep	
COORDINATES	X	Y	X	Y	X	Y
SCREEN LOCATION						
GUN	230.0	42.1	230.0	42.1	230.0	42.1
1	+ 2.6	+8.9	+ 2.4	+9.1	+ 2.1	+9.1
6	+ 5.9	+9.0	+ 4.9	+9.2	+ 4.7	+9.3
8	+ 5.6	+7.5	+ 4.4	+8.0	+ 4.2	+8.5
9	+ 6.6	+9.3	+12.0	+12.3	+ 1.1	+10.1
10	+ 8.4	+9.3	+14.9	+13.0	+ 2.6	+11.0
					+ 3.4	+10.7
11	+ 9.1	+8.4	+17.0	+13.1	+ 2.7	+11.3
					+ 3.7	+11.1

DATE	3 Sep		13 Oct	
SCREEN LOCATION				
GUN	230.0	42.1	274.0	42.1
1	+ 2.1	+9.1	- 1.3	+10.6
6	+ 4.7	+8.9	+ 3.4	+7.4
8	+ 4.9	+7.8	+ 7.3	+4.6
9	+ 4.5	+8.8	+11.0	+ .7
10	+ 5.8	+9.1	+11.7	+ .5
11	+ 5.7	+8.5	+11.6	-2.7

7.62 M80 BALL, 1944 FT/SEC, 26.6 INCHES

SHOT DATE COORDINATES SCREEN LOCATION GUN	1 ² 9 Sep		2 10 Sep		3 10 Sep		4 ² 10 Sep	
	X	Y	X	Y	X	Y	X	Y
1	220.0	26.6	222.0	26.6	230.0	26.6	230.0	26.6
6	- .4	+9.8	- .6	+9.6	- .3	+10.4	- .6	+9.4
8	- 9.9	+10.6	- 6.4	+11.0	- 4.6	+13.7	- 7.0	+10.2
9	-14.9	+9.4	-8.6	+10.4	- 2.5	+13.0	- 6.4	+9.6
10	-14.1	+9.2					- 6.8	+8.9
11	-41.9	13.6	-17.9	+17.3	- 1.4	+8.3	-11.0	+10.8
	-46.1	+13.7	-18.5	+17.4	- .5	6.7	-10.9	+10.6
	-52.5	+12.6	-19.9	+16.8	- .1	+4.1	-11.3	+9.2

SHOT DATE GUN	5 10 Sep		6 10 Sep		7 11 Sep		8 11 Sep	
	X	Y	X	Y	X	Y	X	Y
1	230.0	26.6	230.0	26.6	238.0	26.6	238.0	26.6
6	- .4	+10.2	- .4	+10.2	+ 1.9	+9.2	+ 1.2	+10.2
8	- 7.3	+10.5	- 8.0	+12.3	+ 4.6	+6.1	+ 3.4	+7.4
9	-11.6	+9.4	-14.2	+14.0	+ 6.3	+1.6	+ 3.4	+5.2
10	+24.3	+16.1	-34.5	+25.2	- .5	+1.8	+ 7.2	+6.2
11	-25.4	+17.1	-37.2	+27.0	- .9	+2.6	+ 8.1	+6.2
	-27.0	+18.1	-40.5	+28.0	- 1.6	+2.8	+10.6	+6.0

SHOT DATE GUN	9 11 Sep		10 26 Sep		11 26 Sep		12 26 Sep	
	X	Y	X	Y	X	Y	X	Y
1	238.0	26.6	242.0	26.6	240.0	26.6	242.0	26.6
6	+ 1.9	+9.2	- .6	+10.1	- .8	+9.9	- .8	+9.9
8	+ 6.1	+5.6	- .2	+8.8	- 3.7	+7.8	- 2.4	+11.0
9	+ 8.3	+1.3	+ 6.0	+6.1	- 4.8	+5.0	- .1	+9.9
10	+15.2	0.0	+18.2	+8.7	- 3.8	+8.1	- 2.1	+7.5
11	+ 5.2	- .3	+20.7	+9.1	- 2.5	+8.3	- 2.8	+7.4
	+ 2.1	-1.1	+23.7	+8.9	- 1.4	+7.8	- 4.4	+6.6

SHOT DATE GUN	13 26 Sep		14 2 Oct		15 2 Oct		16 2 Oct	
	X	Y	X	Y	X	Y	X	Y
1	242.0	26.6	248.0	26.6	249.0	26.6	248.0	26.6
6	- .7	+9.9	0.0	+8.7	0.0	+8.7	+ 0.0	+8.7
8	- 1.8	+6.8	+ .6	+5.1	+ .	+6.8	+ 1.2	+6.1
9	- .5	+2.2	- .6	+2.6	+ 4.4	+5.8	- .8	+3.0
10	- 3.9	-1.4	+ 1.7	+1.0	- 1.5	+4.8	- 2.1	+3.3
11	- 3.8	-2.5	+ 3.5	0.0	- 1.9	+4.5	- 1.4	+2.7
	- 4.1	-4.6	+ 4.0	-2.5	- 3.0	+2.8	- 1.3	+ .1

SHOT DATE GUN	17 2 Oct		18 3 Oct		19 3 Oct		20 3 Oct	
	X	Y	X	Y	X	Y	X	Y
1	248.0	26.6	258.0	26.6	258.0	26.6	258.0	26.6
6	0.0	+8.4	+ .1	+8.6	- .1	+9.4	- .2	+8.1
8	+ .1	+4.6	- 5.1	+6.3	+ .5	+4.5	- 1.4	+6.8
9	- 1.1	+1.7	-10.3	+3.9	- .3	+4.2	- 5.8	+5.4
10	- 7.5	-3.9	-23.6	+20.0	+ 8.5	+6.7	-15.5	+1.7
11	- 6.8	-4.6	-25.9	+24.6	+10.4	+7.8	-17.6	+ .6
	- 6.1	-7.6	-26.3	+28.5	+12.6	+6.5	-18.6	-2.6

7.62 M80 BALL, 1944 FT/SEC., 26.6 INCHES

SHOT	21		22 ²		23 ²		24 ²	
DATE	3 Oct		9 Sep		9 Sep		10 Sep	
COORDINATES	X	Y	X	Y	X	Y	X	Y
GUN	260.0	26.6	222.0	26.6	222.0	26.6	220.0	26.6
1	- .1	+ 8.4	- .4	+ 8.9	- .4	+ 9.6	- .6	+ 9.6
6	+ 4.6	+ 7.2	- 1.3	+ 4.9	-10.7	+11.1	+ .6	+10.1
8	+ 3.3	+ 5.3	+ 4.1	- 1.5	+19.8	+11.2	+ 8.3	+ 7.7
9	+ .5	+ 2.1			+45.5	+16.3		
10	+ .6	+ 2.1						
11	+ .7	+ 1.5						

SHOT	25 ²		26		27 ¹		28 ²	
DATE	10 Sep		11 Sep		11 Sep		11 Sep	
GUN	230.0	26.6	236.0	26.6	236.0	26.6	238.0	26.6
1	- .2	+10.8	+ 1.2	+10.3	+ 1.2	+ 9.5	+ 2.0	+ 9.1
6	+ .2	+10.3	+ 1.5	+10.3	+ 1.7	+ 8.4	+ 1.7	+ 3.9
8	+ 8.4	+ 6.4	+ 3.6	+ 8.6	+ 3.6	+ 6.2	- .6	- 3.9
9			+ 4.5	+13.5	- 3.3	+ 2.2		
					- 2.8	+ 1.2		
10			+ 5.7	+14.1	- 4.0	+ .6		
					- 3.3	+ 0.0		
11			+ 7.5	+14.1	- 5.1	- 1.2		
					- 5.0	- 2.4		

SHOT	29 ²		30 ²		31 ²		32 ²	
DATE	11 Sep		26 Sep		2 Oct		3 Oct	
GUN	238.0	26.6	242.0	26.6	248.0	26.6	258.0	26.6
1	+ 1.9	+ 9.2	- .7	+ 9.8	+ 1.8	+ 8.9	+ 1.5	+ 8.4
6	+ 5.1	+ 6.3	- 1.0	+ 9.5	+39.9	+ 7.7	+13.5	- 5.8
8			+ 1.9	+14.9				
9								
10								
11								

1. Projectile Breakup
2. Unstable

7.62 M80 BALL, 1944 FT/SEC., 42.1 INCHES

SHOT DATE COORDINATES SCREEN LOCATION GUN	1 2 Sep		2 ² 2 Sep		3 ² 2 Sep		4 2 Sep	
	X	Y	X	Y	X	Y	X	Y
1	224.0	42.1	224.0	42.1	224.0	42.1	224.0	42.1
6	+ .9	+ 7.1	+ .9	+ 6.3	+ 1.2	+ 6.1	+ 1.2	+ 6.1
	+ .1	+ 3.1	+ .2	+ 4.5	+ 1.9	+ 5.5	+ 1.3	+ 4.5
8					+ .9	+ 6.5		
	+ .1	+ .9	- .8	+ 3.7	+ 2.1	+ 4.7	+ .7	+ 2.9
					+ 1.9	+ 3.9		
9	- .1	+ 1.1	- 1.6	- .8	+ 3.1	+ .1	- 1.4	+ 1.0
			- 2.6	- 1.1	+ 3.7	- 1.0		
10	- 1.8	- 1.0	+ .1	- 1.0	+ 3.6	- .1	- .2	+ 1.0
			- .8	- 1.0	+ 3.7	- 1.1		
11	- 2.3	- 1.6	- 1.3	- 2.7	+ 3.0	- 1.2	- .7	+ .4
					+ 2.7	- 2.2		

SHOT DATE COORDINATES SCREEN LOCATION GUN	5 ² 3 Sep		6 ² 3 Sep		7 ² 4 Sep		8 ² 4 Sep	
	X	Y	X	Y	X	Y	X	Y
1	232.0	42.1	232.0	42.1	238.0	42.1	238.0	42.1
6	+ 2.1	+ 8.6	+ 3.1	+ 8.6	- .1	+ 7.8	+ .7	+ 7.8
	+ 5.9	+ 7.1	+ 6.6	+ 8.2	- .9	+ 5.3	- 1.9	+ 7.3
8	+ 4.0	+ 4.4	+ 6.4	+ 7.0	+ 7.4	+ 3.4	- 2.6	+ 3.4
9	- .9	+15.5	+ 3.6	+11.1	- 7.0	+ 3.2	- 7.0	+ 3.2
	- 1.9	+14.7	+ 2.5	+10.8				
10	+ .6	+16.4	+ 3.1	+12.8	- 5.5	+ 3.8	- 5.5	+ 3.8
	- .5	+16.2	+ 3.1	+11.5	- 6.5	+ 3.6	- 6.5	+ 3.6
11	- 1.3	+17.8	+ 2.5	+12.8	- 5.5	+ 3.5	- 5.5	+ 3.5
	- 1.6	+17.0						

SHOT DATE COORDINATES SCREEN LOCATION GUN	9 4 Sep		10 ² 4 Sep		11 13 Oct		12 13 Oct	
	X	Y	X	Y	X	Y	X	Y
1	238.0	42.1	238.0	42.1	276.0	42.1	276.0	42.1
6	+ .2	+ 7.3	+ .2	+ 7.3	- 1.3	+10.1	- 1.7	+10.1
	- 1.3	+ 2.3	- 1.5	+ 2.3	+ 3.2	+ 6.1	+ 2.2	+ 9.3
8	- 3.8	- 1.1	+ 6.4	- 1.7	+ 4.2	+ 2.5	+ 4.1	+ 9.4
9	- 2.0	- 2.0	+ 1.1	+11.2	+10.9	- .9	+ 6.7	+16.7
10	- 5.3	- 1.7	- .9	+14.4	+12.5	- 1.7	+ 7.3	+17.9
			- 1.9	+13.8				
11			- 4.6	+16.3	+14.9	- 5.9	+ 7.5	+16.6

SHOT DATE COORDINATES SCREEN LOCATION GUN	13 13 Oct		14 13 Oct		15 14 Oct		16 14 Oct	
	X	Y	X	Y	X	Y	X	Y
1	276.0	42.1	276.0	42.1	284.0	42.1	284.0	42.1
6	- 1.7	+10.2	- 1.6	+10.3	- 1.5	+ 8.6	- 1.7	+ 8.7
	+ 1.4	+ 5.9	+ 2.3	+ 6.4	+ 4.4	+ 5.4	+ 4.9	+ 5.3
8	+ 3.4	+ 3.7	+ 3.6	+ 2.9	+ 5.9	+ 2.4	+ 6.7	+ 2.2
9	+ 7.1	+ 1.6	+ 7.3	+ 4.7	+ 9.2	- .1	+ 7.2	+ .2
10	+ 7.4	+ 1.0	+ 9.5	+ 4.1	+ 9.2	- .9	+ 7.6	- .3
11	+ 6.9	- 2.4	+13.5	+ 1.8	+ 8.6	- 5.2	+ 6.5	- 3.6

SHOT DATE COORDINATES SCREEN LOCATION GUN	17 14 Oct		18 14 Oct		19 14 Oct		20 14 Oct	
	X	Y	X	Y	X	Y	X	Y
1	284.0	42.1	284.0	42.1	290.0	42.1	290.0	42.1
6	- 1.6	+ 9.4	- 1.7	+ 9.3	- 1.3	+ 7.8	- 1.8	+ 8.7
	+ 4.1	+ 7.3	+ 4.7	+ 7.6	+ 7.1	+ 6.9	- 2.4	+ 9.8
8	+ 5.7	+ 4.7	+ 6.4	+ 4.9	+10.1	+ 4.0	- 5.8	+11.7
9	+ 7.6	+ 5.4	+ 8.3	+ 5.2	+10.6	+ 2.9	-16.0	+16.3
10	+ 7.6	+ 5.4	+ 8.7	+ 5.2	+11.0	+ 3.0	-17.6	+17.2
11	+ 7.8	+ 2.5	+ 8.9	+ 2.2	+10.7	- .2	-20.1	+15.2

1. Projectile Break Up
2. Unstable

7.62 M80 BALL, 1944 FT/SEC., 42.1

SHOT	21 ²		22		23	
DATE	2 Sep		13 Oct		14 Oct	
COORDINATES	X	Y	X	Y	X	Y
SCREEN LOCATION						
GUN	224.0	42.1	276.0	42.1	284.0	42.1
1	+ 2.2	+ 7.3	- 1.4	+10.3	- 1.6	+ 8.6
6	+ 9.6	+ 3.3	+ .4	+ 5.9	+ .4	+ 5.2
8			+ .1	+ 4.4	+ 6.2	+ 2.0
9			- .1	+14.1	+ 7.2	+ 3.4
10			+ .9	+16.2	+ 8.3	+ 4.5
11			+ 1.2	+14.6	+ 9.0	+ 1.1

1. Projectile Break Up
2. Unstable

5.56 M193 BALL, 3200 FT/SEC., 26.6 INCHES

SHOT DATE COORDINATES SCREEN LOCATION GUN	1 2 Oct		2 10 Sep		3 10 Sep		4 10 Sep	
	X	Y	X	Y	X	Y	X	Y
1	244.0	26.6	224.0	26.6	224.0	26.6	232.0	26.6
6	+ .6	+ 8.6	- .4	+ 9.4	- .5	+ 9.6	- 1.1	+ 9.6
8	+ 5.7	+ 6.2	+ 7.1	+ 9.3	- 3.7	+ 9.1	- 7.1	+ 7.7
9	+27.4	+ 6.1	- 4.1	+ 8.7	- 2.6	+ 7.2	- 7.6	+ 4.7
10	+16.4	+18.2	+ 6.9	- 9.4	- 6.5	- 2.0	-13.0	+ 6.1
11	+20.7	+11.8	+14.9	- 8.2	- 7.6	- 5.2	-13.1	+ 6.0
	+20.6	+ 9.0	+12.9	-11.4	-11.2	- 9.1	-13.8	+ 5.0
SHOT DATE COORDINATES SCREEN LOCATION GUN	5 10 Sep		6 ¹ 10 Sep		7 2 Oct		8 2 Oct	
	X	Y	X	Y	X	Y	X	Y
1	232.0	26.6	232.0	26.6	244.0	26.6	252.0	26.6
6	- .9	+ 9.6	- 1.1	+ 9.6	+ .2	+ 7.9	- 2.1	+ 8.3
8	- 7.4	+ 7.5	- 1.7	+ 6.1	+ 2.3	+ 6.6	+ .4	+ 6.8
9	- 8.6	+ 5.0	+ 2.2	+ 2.0	+ 1.6	+ 5.7	- 4.9	+ 6.4
	-17.1	+ 3.0	+ 3.7	+ 6.3	+ 4.3	+ 7.7	+ 6.6	+ .7
			+ 4.0	+ 6.1				
10	-18.1	+ 4.5	+ 4.0	+ 4.6	+ 4.0	+ 7.5	+ 9.0	+ 5.2
			+10.0	+ 7.2				
			+ 9.2	+ 6.8				
11	-19.6	+ 5.1	+ 9.1	+11.6	+ 4.4	+ 6.5	+10.2	+ 3.6
			+14.6	+ 7.4				
			+15.0	+ 7.0				
			+14.4	- 1.9				
SHOT DATE COORDINATES SCREEN LOCATION GUN	9 2 Oct		10 2 Oct		11 8 Oct		12 8 Oct	
	X	Y	X	Y	X	Y	X	Y
1	252.0	26.6	252.0	26.6	264.0	26.6	264.0	26.6
6	- 2.2	+ 8.2	- 2.1	+ 8.4	+ .4	+10.0	- .2	+ 8.7
8	- 6.7	+ 3.8	- 6.9	+ 6.7	+10.4	+ 6.6	- 1.7	+10.0
9	-10.5	+ 1.7	-11.8	+ 5.0	+14.4	+ 2.2	- 7.7	+10.0
10	-12.3	+ 2.4	-15.0	+ 9.7	+18.1	- 2.4	-11.3	+18.0
11	-11.6	+ 3.0	-14.7	+10.4	+17.0	- 3.2	-13.6	+19.6
	-11.5	+ 2.0	-14.9	+ 9.4	+18.7	-18.4	-16.5	+19.4
SHOT DATE COORDINATES SCREEN LOCATION GUN	13 8 Oct		14 8 Oct		15 8 Oct		16 8 Oct	
	X	Y	X	Y	X	Y	X	Y
1	264.0	26.6	268.0	26.6	268.0	26.6	268.0	26.6
6	+ 1.3	+10.1	- 1.9	+10.0	- 1.9	+10.0	+ 1.1	+10.0
8	+ 5.7	+10.0	+ 9.4	+10.3	+ 7.9	+10.5	+ 7.9	+ 9.1
9	+ 5.3	+11.4	+12.8	+10.1	+ 8.2	+ 9.9	+ 7.2	+ 8.0
10	+ 8.4	+19.5	+27.5	+10.7	+16.9	+14.0	+ 6.2	+ 7.6
11	+ 8.4	+23.1	+30.9	+10.8	+18.6	+14.0	+ 5.9	+ 7.0
	+ 8.6	+23.5	+34.6	+10.0	+20.9	+22.0	+ 5.5	+ 4.5
SHOT DATE COORDINATES SCREEN LOCATION GUN	17 9 Oct		18 9 Oct		19 9 Oct		20	
	X	Y	X	Y	X	Y	X	Y
1	272.0	26.6	272.0	26.6	274.0	26.6		
6	0.0	+10.6	- 1.2	+10.6	- 1.1	+11.6		
8	+ 6.6	+ 5.3	+ 1.7	+10.3	+ 1.2	+ 5.9		
9	+ 8.1	+ 2.9	+ .2	+ 9.6	- .4	+ 1.7		
10	+ 9.4	+ 6.0	+ 4.7	+ 6.3	- 1.5	+ 7.7		
11	+10.4	+ 5.2	+ 5.2	+ 5.0	- 1.8	+10.3		
	+10.7	+ 2.5	+ 4.7	+ 1.6				

1. Projectile Break Up
2. Unstable

5.56 M193 BALL, 3200 FT/SEC., 26.6 INCHES

SHOT DATE COORDINATES SCREEN LOCATION GUN	21 10 Sep		22 ² 10 Sep		23 ² 10 Sep		24 ² 10 Sep	
	X	Y	X	Y	X	Y	X	Y
1	224.0	26.6	224.0	26.6	232.0	26.6	232.0	26.6
6	- .1	+ 9.2	- .1	+ 9.2	- 1.1	+ 9.7	+ 6.3	+ 9.7
8	- 2.3	+10.8	- .9	+14.1	- 7.3	+10.2	- 4.2	+ 9.6
9	- .3	+ 9.3	+ 2.7	+21.4	-11.0	+10.6	+ 4.8	+ 9.0
10	-39.3	+19.7						
11	-45.4	+19.3						
SHOT DATE COORDINATES SCREEN LOCATION GUN	25 ² 2 Oct		26 ² 2 Oct		27 ² 2 Oct		28 ² 2 Oct	
	X	Y	X	Y	X	Y	X	Y
1	244.0	26.6	244.0	26.6	244.0	26.6	252.0	26.6
6	+ 2.7	+13.3	+ .6	+ 7.8	+ .6	+ 8.2	- .2	+ 8.2
8	+15.4	0.0	+ 4.1	+ 7.7	+ 8.9	+ 4.0	+22.6	+ 7.0
9			+11.7	+16.1	+18.5	- 1.5	+19.2	+ 5.9
10							+39.0	+ 5.8
11								
SHOT DATE COORDINATES SCREEN LOCATION GUN	29 ² 2 Oct		30 ² 3 Oct		31 ² 3 Oct		32 ² 3 Oct	
	X	Y	X	Y	X	Y	X	Y
1	252.0	26.6	260.0	26.6	260.0	26.6	260.0	26.6
6	- .2	+ 8.6	- .1	+ 8.6	- .1	+ 8.6	- .6	+ 9.4
8	+22.6	+ 1.5	+35.2	0.0	+15.2	0.0	+30.4	+ .8
9	+16.8	- 4.4	+35.2	- 3.1	+15.2	+ 6.9	+23.6	+17.9
10								
11								
SHOT DATE COORDINATES SCREEN LOCATION GUN	33 ² 3 Oct		34 ² 8 Oct		35 ² 8 Oct		36 ² 8 Oct	
	X	Y	X	Y	X	Y	X	Y
1	260.0	26.6	264.0	26.6	264.0	26.6	268.0	26.6
6	- .2	+10.1	+ .4	+ 9.8	+ 1.3	+ 9.8	+ 1.3	+10.0
8	+33.4	+ 6.3	+38.4	+ .3	+36.4	+ 1.5	+34.9	+13.8
9					+36.3	- 4.4	+44.0	+ 2.5
10								
11								
SHOT DATE COORDINATES SCREEN LOCATION GUN	37 8 Oct		38 ² 9 Oct		39 ² 9 Oct		40 ² 9 Oct	
	X	Y	X	Y	X	Y	X	Y
1	268.0	26.6	272.0	26.6	272.0	26.6	272.0	26.6
6	+ 1.1	+10.0	+ .5	+ 9.2	+ .2	+ 9.8	+ .2	+10.6
8	+34.2	+11.5	+30.9	+ 8.8	+23.9	+ 1.1	+35.1	+ 2.6
9	+30.4	+13.9	+38.1	+ 6.7			+31.7	- 4.4
10	+15.6	+18.3						
11	+14.9	+18.8						
11	+14.3	+17.8						

1. Projectile Break Up
2. Unstable

5.56 M193 BALL, 3200 FT/SEC., 26.6 INCHES

SHOT		40 ²
DATE		9 Oct
COORDINATES	X	Y
SCREEN LOCATION		
GUN	272.0	26.6
1	- .9	+10.4
6	+35.2	- 4.9
8		
9		
10		
11		

1. Projectile Break Up
2. Unstable

5.56 M193 BALL, 3200 FT/SEC., 42.1 INCHES

SHOT DATE COORDINATES SCREEN LOCATION GUN	1 ¹ 28 Aug		2 ² 28 Aug		3 28 Aug		4 2 Sep	
	X	Y	X	Y	X	Y	X	Y
1	220.0	42.1	220.0	42.1	220.0	42.1	228.0	42.1
6	+ .9	+ 7.4	+ .9	+ 7.4	+ .9	+ 7.4	- .7	+ 6.4
8	+ .8	+ 5.9	+ .6	+ 5.0	+ 1.4	+ 6.9	- 3.6	+ 4.0
9	- .2	+ 3.2	- .2	+ 2.4	+ 2.9	+ 6.1	- 4.3	+ 3.9
	+ 8.2	+ 5.3	+ 8.7	- 1.5	+ 1.3	+ 6.6	- .9	+ .5
10	+ 8.1	+ 4.5	+ 9.5	- 1.8			- .3	+ .3
	+13.7	+ 6.3	+14.6	- 3.2	+ 2.6	+ 6.5	+ .9	+ 1.9
11	+12.6	+ 5.8	+15.1	- 3.5			+ 1.4	+ 1.4
	+18.7	+ 9.5	+18.4	- 6.2	+ 1.6	+ 5.6	+ 6.2	+ 2.5
	+15.4	+ 4.3	+19.1	- 6.2				
SHOT DATE GUN	5 2 Sep		6 ² 3 Sep		7 4 Sep		8 8 Sep	
	X	Y	X	Y	X	Y	X	Y
1	228.0	42.1	228.0	42.1	236.0	42.1	242.0	42.1
6	- .7	+ 6.4	+ .6	+ 5.7	+ 1.0	+ 6.3	+ 2.6	+ 6.2
	- 2.6	+ 1.1	+ .8	+ .4	+ 1.2	- .1	+ 1.2	- .7
8							+ .8	- .4
9	- 5.1	- 2.8	+ .7	1.5	- .6	- 2.5	- .6	- 2.6
	- 8.6	- 6.5	+11.6	- 3.7	+ 3.7	- 5.2	+ 1.0	- 1.6
10			+10.8	- 3.9			+ .5	- 2.0
	- 8.4	- 7.5	+16.7	- 4.0	+ 6.2	- 6.0	+ .4	- 1.4
11			+16.4	- 4.7				
	-10.0	- 9.2	+21.8	- 5.2	+ 6.7	- 8.2	+ 1.1	- 2.7
			+21.5	- 5.9				
SHOT DATE GUN	9 8 Sep		10 ¹ 8 Sep		11 14 Oct		12 14 Oct	
	X	Y	X	Y	X	Y	X	Y
1	242.0	42.1	244.0	42.1	278.0	42.1	278.0	42.1
6	+ 2.6	+ 7.3	+ .9	- 1.5	- 1.1	+ 9.6	- 1.1	+ 9.7
8	+ 4.4	- .3	- .2	+ 3.3	+ 3.4	+ 7.1	+ 4.4	+ 8.3
9	+ 4.7	- 4.3	- .1	+ 1.8	+ 5.9	+ 4.2	+ 6.7	+ 5.7
	+ 3.5	- 4.9	- 6.0	+ 9.1	+ 6.4	+ 4.3	+ 8.1	+ 6.6
10			- 5.4	+ 6.7				
	+ 3.7	- 4.5	- 8.1	+12.9	+ 6.9	+ 4.6	+ 8.7	+ 6.5
11			- 6.6	+ 7.4				
	+ 4.4	- 6.0	-10.4	+17.1	+ 7.1	+ 1.9	+ 8.4	+ 3.7
			- 8.0	+ 6.6				
SHOT DATE GUN	13 14 Oct		14 14 Oct		15 16 Oct		16 16 Oct	
	X	Y	X	Y	X	Y	X	Y
1	286.0	42.1	286.0	42.1	294.0	42.1	294.0	42.1
6	- 1.2	+ 9.5	- 1.6	+ 8.6	- 1.6	+11.6	- 1.6	+11.6
8	+ 4.4	+ 8.6	+ 2.7	+ 6.8	+ .5	- 5.0	- 2.4	+11.2
9	+ 5.4	+ 6.9	+ 2.4	+ 5.0	+ 2.1	+ .2	- 1.7	+ 9.7
10	+ 5.3	+ 9.2	0.0	+11.1	+ .4	-13.7	- 1.9	+12.2
11	+ 5.4	+ 9.4	+ .6	+11.7	+ .5	-17.5	- 1.1	+13.0
	+ 4.6	+ 6.7	+ .5	+ 9.6			- 1.8	+10.7
SHOT DATE GUN	17 16 Oct		18 16 Oct		19		20	
	X	Y	X	Y	X	Y	X	Y
1	296.0	42.1	296.0	42.1				
6	- 1.3	+11.1	- .7	+11.1				
8	+ 2.7	+ 7.6	+ 6.7	+11.9				
9	+ 3.3	+ 3.2	+ 8.9	+ 8.5				
10	+ 5.1	- 6.4	+ 7.6	+ 9.6				
11	+ 6.4	- 8.8	+ 8.4	+10.8				
	+ 6.7	-15.3	+ 8.7	+ 8.6				

1. Projectile Break Up
2. Unstable

5.56 M193 BALL, 3200 FT/SEC., 42.1 INCHES

SHOT	21 ²		221,2		23		24	
DATE	28 Aug		28 Aug		3 Sep		4 Sep	
COORDINATES	X	Y	X	Y	X	Y	X	Y
SCREEN LOCATION								
GUN	220.0	42.1	220.0	42.1	228.0	42.1	236.0	42.1
1	+ 1.4	+ 5.6	+ 1.3	+ 8.6	+ .5	+ 6.0	+ 1.3	+ 5.9
6	+ 6.8	+ 4.4	+ .7	+ 3.3	+ .9	- .2	+ 1.9	+ 1.0
8	+ 2.9	+ 6.6	+ .4	+ 3.4	- .9	- 4.1	+ 1.5	- 1.1
9					- 3.9	- 3.5	+ 7.4	- 7.5
10					- 4.0	- 3.5	+ 9.4	- 8.3
11					- 6.5	- 4.0	+ 9.5	-10.0
SHOT	25 ²		26 ²		27 ²		28 ²	
DATE	4 Sep		8 Sep		8 Sep		8 Sep	
GUN	236.0	42.1	242.0	42.1	242.0	42.1	242.0	42.1
1	+ 1.0	+ 6.1	+ 2.3	+ 5.9	+ 2.8	+ 6.2	+ 2.6	+ 6.5
6	+ 3.4	+ 1.0	+ 2.3	- 4.2	+ 3.8	- .5	+ 4.6	- 2.1
					+ 4.2	- 1.1		
8	- 8.9	- .1	- 6.7	+ 2.9	+ 3.8	- 2.0	+ 4.3	- 6.1
9	+ 2.4	- 4.2						
10	+ 3.7	- 4.4						
11	+ 3.1	- 5.4						
	+ 3.4	- 5.9						
SHOT	29		30		31		32 ²	
DATE	14 Oct		14 Oct		14 Oct		14 Oct	
GUN	278.0	42.1	278.0	42.1	278.0	42.1	286.0	42.1
1	- 3.1	+ 9.6	- .6	+10.3	- 1.3	+ 9.6	- 1.1	+ 8.6
6	- 1.9	+ 7.3	+ 6.6	+ 8.6	+ 3.2	+ 7.4	+ 3.5	+11.5
8	- .7	+ 4.6	+ 8.8	+ 5.0	+ 5.3	+ 4.0	+ 5.8	+13.7
9	- .6	+ 4.7	+ 7.1	+ 6.7	+ 7.2	+ 3.9	+12.7	+24.1
10	- .4	+ 4.0	+ 8.2	+ 5.4	+ 9.2	+ 4.1		
11	- 1.0	+ .2	+ 8.2	+ 4.8	+10.6	+ 1.2		
SHOT	33 ²		34 ²		35 ²		36	
DATE	14 Oct		16 Oct		16 Oct		16 Oct	
GUN	286.0	42.1	294.0	42.1	294.0	42.1	296.0	42.1
1	- 1.3	+ 9.2	- 2.4	+ 9.6	- 2.7	+ 9.4	- 1.1	+ 9.1
6	- 1.3	+11.8	- 8.3	+11.3	-10.8	+ 6.3	+ 1.3	+ 9.8
8	- 2.2	+15.6	-10.7	+ 6.7	-13.8	+ 8.1	+ 1.9	+ 7.5
9							- 1.2	+ 8.2
10							- 1.7	+ 8.7
11							- 3.5	+ 6.5
SHOT	37 ²		38		39		40	
DATE	16 Oct							
GUN	296.0	42.1						
1	- .9	+ 9.2						
6	+19.1	- 9.5						
8								
9								
10								
11								

1. Projectile Break Up
2. Unstable

5.56 M193 BALL, 2300 FT/SEC., 26.6 INCHES

SHOT	12		2		3		4	
DATE	10 Sep		10 Sep		2 Oct		10 Sep	
COORDINATES	X	Y	X	Y	X	Y	X	Y
SCREEN LOCATION								
GUN	226.0	26.6	226.0	26.6	246.0	26.6	226.0	26.6
1	- .4	+ 9.8	- .6	+ 9.9	- .6	+ 8.3	+ .7	+10.2
6	- 6.7	+ 9.2	- 6.3	+ 9.2	- 2.6	+ 4.5	- 1.7	+11.7
8	- 8.8	+ 8.8	- 8.8	+ 8.1	+ .6	+ 2.9	- 1.1	+10.0
9	-12.1	+14.4	-20.0	+15.5	+ 7.5	- 3.3	- 5.9	+18.0
	-12.4	+13.9						
10	-11.6	+14.5	-21.0	+13.7	+ 8.5	- 5.0	- 5.9	+19.3
11	-11.5	+14.3	-22.5	+14.0	+ 9.7	- 7.5	- 6.2	+20.4

SHOT	5		6		7		8	
DATE	10 Sep		3 Oct		11 Sep		3 Oct	
GUN	226.0	26.6	254.0	26.6	234.0	26.6	254.0	26.6
1	- .5	+10.1	- 1.0	+ 7.2	- .5	+ 8.9	- 1.1	+ 8.6
6	- 6.7	+ 8.4	- 1.4	+ 1.0	- 3.5	+ 8.8	- .8	+ 9.1
8	- 7.6	+ 4.1	+ 2.6	- 2.6	- 2.3	+ 7.5	- 2.8	+ 9.4
9	-22.7	+ 6.2	+13.6	- 6.9	- 5.9	+15.5	+15.4	+ 7.7
10	-24.2	+ 6.5	+14.4	- 8.5	- 5.5	+16.0	+19.0	+ 4.5
11	-25.8	+ 4.9	+14.7	-11.0	- 5.6	+15.8	+22.7	+ 3.3

SHOT	9		10		11		12	
DATE	3 Oct		8 Oct		8 Oct		8 Oct	
GUN	254.0	26.6	266.0	26.6	266.0	26.6	266.0	26.6
1	- .8	+ 8.9	+ .1	+11.0	+ .2	+11.1	+ .7	+11.2
6	- 1.4	+ 5.3	+ 1.1	+11.7	+ 3.4	+10.3	+ .6	+ 9.7
8	- 5.8	+ .1	- .7	+11.7	+ 3.2	+ 9.5	- 4.2	+ 9.1
9	- 3.8	- 4.4	+ 1.1	+14.5	+12.1	+11.5	-15.6	+ 7.8
10	-14.4	- 4.4	+ 1.1	+14.6	+13.1	+11.8	-18.9	+ 8.6
11	-15.5	- 5.6	+ 1.2	+13.9	+14.4	+10.8	-18.6	+ 7.3

SHOT	13		14		15		16	
DATE	8 Oct		8 Oct		8 Oct		9 Oct	
GUN	270.0	26.6	270.0	26.6	270.0	26.6	274.0	26.6
1	+ .8	+10.2	+ .3	+ 9.7	+ 8.4	+10.2	- 1.4	+11.1
6	+ 6.3	+11.1	- .7	+15.0	+ 8.9	+11.3	+ 4.6	+ 5.2
8	+ 4.7	+ 9.9	- 4.7	+16.1	+10.3	+11.6	+ 6.4	+ 2.0
9	+ 2.5	+15.2	-13.8	+20.9	+19.4	+19.2	+20.7	+ 1.3
10	+ 2.1	+15.8	-15.5	+21.8	+20.6	+20.7	+24.0	+ .5
11	+ 1.6	+15.4	-18.0	+20.1	+21.6	+20.9	+28.0	- 2.1

SHOT	17		18	
DATE	9 Oct		9 Oct	
GUN	276.0	26.6	276.0	26.6
1	- .3	+11.1	- 1.0	+10.8
6	+ 3.2	+ 9.6	+ 5.3	+ 9.0
8	- .6	+ 6.9	+ 5.3	+ 7.6
9	- 7.4	+ 7.8	+12.2	+12.2
10	- 8.3	+ 7.7	+13.6	+13.0
11	- 8.8	+ 5.3	+14.9	+12.4

1. Projectile Break Up
2. Unstable

5.56 M193 BALL, 2300 FT/SEC., 26.6 INCHES

SHOT DATE COORDINATES SCREEN LOCATION GUN	21 ² 10 Sep		22 ² 11 Sep		23 ² 11 Sep		24 ² 11 Sep	
	X	Y	X	Y	X	Y	X	Y
1	226.0	26.6	234.0	26.6	234.0	26.6	234.0	26.6
6	- .8	+ 9.8	- .1	+ 9.3	+ 8.5	+ 8.7	- .4	+ 9.3
8	- 5.0	+10.0	- 1.4	+13.6	-10.0	+ .3	- 2.7	+ 8.1
9	- 4.8	+ 7.5	+ 6.9	15.2			+ 5.3	+ 2.9
10	- 3.5	+17.1					-21.6	+11.2
11	- 2.4	+18.5					-25.4	+ 2.5
	- 1.8	+19.6					-33.9	+ 3.1
	- 1.5	+18.9						

SHOT DATE COORDINATES SCREEN LOCATION GUN	25 ² 11 Sep		26 ² 2 Oct		27 ² 2 Oct		28 ² 2 Oct	
	X	Y	X	Y	X	Y	X	Y
1	234.0	26.6	246.0	26.6	46.0	26.6	246.0	26.6
6	- .2	+ 9.8	+ 1.8	+ 8.2	+ 1.4	+ 8.3	+ 1.4	+ 8.4
8	- 5.1	+ 5.0	- 2.7	+ 5.1	- 2.7	+ 4.3	+28.9	+ .3
9	-15.1	+ .1	- 2.2	+ 3.1	- 2.4	+ 1.0	+29.8	- 3.3
10			- 4.9	+ 2.0	- 7.0	+ 1.8		
11			- 4.3	+ 1.1	- 6.9	+ 1.7		
			- 4.3	- .5	- 6.8	+ .8		

SHOT DATE COORDINATES SCREEN LOCATION GUN	29 ² 3 Oct		30 ² 3 Oct		31 ² 3 Oct		32 ² 3 Oct	
	X	Y	X	Y	X	Y	X	Y
1	254.0	26.6	254.0	26.6	262.0	26.6	262.0	26.6
6	- .7	+ 7.6	- .7	+ 8.7	- .5	+10.1	- .7	+ 9.9
8	+38.9	+ .8	+24.2	+ 3.2	+27.9	+ 5.3	+40.9	- 2.7
9	+44.7	- 2.0	+17.2	- 2.5	+33.5	+ .1	+54.1	+ .9
10			+ 4.2	+21.0	+19.1	-14.5		
11			+ 2.9	+25.7				
			+ 1.1	+30.0				

SHOT DATE COORDINATES SCREEN LOCATION GUN	33 ² 3 Oct		34 ² 3 Oct		35 ² 3 Oct		36 ² 8 Oct	
	X	Y	X	Y	X	Y	X	Y
1	262.0	26.6	262.0	26.6	262.0	26.6	266.0	26.6
6	- 1.4	+10.1	- 1.2	+10.4	- 1.2	+10.1	+ .2	+10.4
8	+39.7	+ 3.0	+39.6	+ 5.5	+14.7	+ 6.1	+17.7	+ 9.3
9	+41.2	- 3.9	+31.2	+ 4.0	+16.7	+ 1.5	+21.5	+ 8.9
10							- 5.1	+19.1
11								

SHOT DATE COORDINATES SCREEN LOCATION GUN	37 ² 8 Oct		38 ² 8 Oct		39 ² 9 Oct		40 ² 9 Oct	
	X	Y	X	Y	X	Y	X	Y
1	270.0	26.6	270.0	26.6	274.0	26.6	276.0	26.6
6	- 1.2	+ 9.9	+ .6	+10.2	- 1.2	+11.2	- .8	+11.2
8	+21.2	+ 4.7	+33.1	+ 1.1	+41.4	+12.6	+39.9	+13.0
9	+22.5	+ 3.2	+33.3	- 1.4			+33.4	+25.2
10	+37.2	+ 4.0					+36.9	+30.2
11	+41.7	+ 3.6						
	+47.4	+ .6						

1. Projectile Break Up
2. Unstable

5.56 M193 BALL, 2300 FT/SEC., 26.6 INCHES

SHOT	41 ²		42 ²	
DATE	9 Oct		9 Oct	
COORDINATES	X	Y	X	Y
SCREEN LOCATION				
GUN	276.0	26.6	276.0	26.6
1	- .6	+11.6	- .7	+11.6
6	+29.6	- 6.0	+44.9	- 3.1
8			+36.6	+ 4.4
9				
10				
11				

1. Projectile Break Up
2. Unstable

5.56 P193 BALL, 2300 FT/SEC., 42.1 INCHES

SHOT DATE COORDINATES SCREEN LOCATION GUN	1 ² 8 Sep		2 2 Sep		3 ² 2 Sep		4 2 Sep	
	X	Y	X	Y	X	Y	X	Y
244.0	42.1	226.0	42.1	226.0	42.1	226.0	42.1	
1	+ .9	+ 9.5	- .4	+ 7.4	- .5	+ 6.6	- .8	+ 7.6
6	- .6	+ 2.5	- 3.2	+ 4.4	+ .6	+ 3.8	- 4.8	+ 3.6
	+ .1	+ 2.4						
8	- 2.3	+ .4	- 4.8	+ 3.0	+ 4.8	+ 4.2	- 6.3	+ 2.0
9	- 4.1	- 7.8	- 8.9	- 3.0	+21.1	+13.7	- 1.1	- 3.5
				- 3.5	+20.6	+13.2		
10	- 3.5	- 9.3	- 8.6	- 4.5	+19.4	+14.3	+ 1	- 4.3
11	- 2.5	-12.6	- 9.6	- 6.9	+28.1	+17.0	+ 1.9	- 6.1
			- 9.9	- 7.9				

SHOT DATE COORDINATES SCREEN LOCATION GUN	5 ² 8 Sep		6 ² 3 Sep		7 3 Sep		8 ² 4 Sep	
	X	Y	X	Y	X	Y	X	Y
244.0	42.1	234.0	42.1	234.0	42.1	234.0	42.1	
1	+ .8	+ 9.7	- .1	+ 6.6	- .1	+ 6.5	+ 2.5	+ 5.7
6	- .5	+ 4.4	+ .2	+ 4.1	+ .7	+ 2.9	+ 3.9	+ 2.6
	- 1.2	+ 4.3						
8	2.3	+ 5.0	- .4	+ 2.9	- .1	- .3	+ 3.2	+ 1.8
9	- 9.4	+10.8	+ .5	+ 3.8	- .5	+ .7	+ 8.6	+ 2.0
							+ 8.4	+ 2.0
10	- 9.2	+12.0	+ 1.3	+ 4.1	- .5	+ .7	+ 9.6	+ 2.3
							+10.1	+ 2.3
11	-12.9	+11.9	+ 1.0	+ 4.3	- 1.3	+ .9	+ 8.9	+ 1.9
			+ .6	+ 3.9			+ 8.9	+ 1.9

SHOT DATE COORDINATES SCREEN LOCATION GUN	9 ² 4 Sep		10 4 Sep		11 14 Oct		12 14 Oct	
	X	Y	X	Y	X	Y	X	Y
234.0	42.1	236.0	42.1	280.0	42.1	280.0	42.1	
1	+ 1.8	+ 5.9	+ 1.0	+ 6.3	- .7	+ 9.8	- 2.2	+ 9.2
6	+ 5.4	+ 1.4	+ 2.0	+ 2.0	+ 7.3	+ 8.0	+ 3.3	+ 4.1
8	+ 5.3	+ 1.6	+ 1.4	+ .5	+ 8.6	+ 4.2	+ 3.9	- 1.1
9	+ 5.1	- 1.3	+ 1.5	- 1.4	+ 7.7	+ 4.3	+ 2.0	- .9
10	+ 5.1	- 1.4	+ 3.2	- 2.0	+ 8.1	+ 3.7	+ 2.9	- .3
	+ 5.2	- 2.0						
11	+ 2.7	- 1.2	+ 2.6	- 3.9	+ 7.3	0.0	+ 2.5	- 2.3
	+ 2.5	- 2.7						

SHOT DATE COORDINATES SCREEN LOCATION GUN	13 14 Oct		14 14 Oct		15 14 Oct		16 14 Oct	
	X	Y	X	Y	X	Y	X	Y
280.0	42.1	280.0	42.1	288.0	42.1	288.0	42.1	
1	- 1.6	+ 9.4	- 1.0	+ 9.3	- 2.1	+ 8.8	- 2.5	+ 8.9
6	+ 1.3	+ 2.3	+ 2.2	+ 6.3	- 3.9	+ 6.5	+ 2.0	+ 7.3
8	+ 1.9	- 2.6	+ 4.5	+ 3.3	- .6	+ 4.4	+ 3.2	+ 4.1
9	- .8	- 8.5	+ 3.5	- .8	- 6.6	+12.8	+ 6.4	+ .1
10	- .7	-12.1	+ 4.6	- .8	- 4.4	+13.4	+ 6.5	- 1.7
11	- 1.8	-16.8	+ 5.0	- 3.8	- 2.9	+11.1	+ 6.4	- 5.7

SHOT DATE COORDINATES SCREEN LOCATION GUN	17 14 Oct		18 16 Oct		19 16 Oct		20 16 Oct	
	X	Y	X	Y	X	Y	X	Y
288.0	42.1	292.0	42.1	292.0	42.1	296.0	42.1	
1	- 2.7	+ 9.2	- 2.3	+11.1	- 2.3	+11.2	- .7	+11.1
6	+ 3.4	+ 7.9	- .8	+10.3	- 5.6	+ 7.0	+ 3.7	+13.8
8	+ 2.7	+ 6.4	+ 2.4	+ 8.4	- 6.4	+ 3.3	+ 5.8	+11.9
9	+ 3.2	+ 7.9	- .4	+ 6.7	- 8.2	- 1.8	+ 3.2	+11.8
10	+ 4.1	+ 8.5	0.0	+ 6.2	- 5.8	- 3.3	+ 3.1	+11.6
11	+ 4.1	+ 5.9	- 1.3	+ 2.2	- 4.9	- 8.4	+ 1.2	+ 8.2

1. Projectile Break Up
2. Unstable

S.56 M193 BALL, 2300 FT/SEC., 42.1 INCHES

SHOT DATE COORDINATES SCREEN LOCATION	21 2 Sep		22 ^{1,2} 2 Sep		23 3 Sep		24 ² 4 Sep	
	X	Y	X	Y	X	Y	X	Y
GUN	226.0	42.1	226.0	42.1	234.0	42.1	234.0	42.1
1	- .7	+ 7.4	- .4	+ 7.4	+ 2.3	+ 5.2	+ 1.6	+ 6.3
6	- 2.8	- 7.2	+10.3	+ 5.8	+ 1.2	+ 1.5	- 2.7	+ 1.4
8	- 3.4	+ 3.6	+22.8	+10.6	+ 1.4	- 2.6	-10.8	+ .1
9	+ 5.4	+13.9			+23.7	+ 1.2		
10	+ 9.7	+16.5			+29.0	- 4.7		
11	+13.7	+21.0			+37.1	- 3.7		

SHOT DATE COORDINATES SCREEN LOCATION	25 ² 14 Oct		26 ² 14 Oct		27 ² 14 Oct		28 ² 16 Oct	
	X	Y	X	Y	X	Y	X	Y
GUN	280.0	42.1	288.0	42.1	288.0	42.1	292.0	42.1
1	- .6	+ 9.1	- 2.4	+ 8.7	- 2.6	+ 9.7	- 1.1	+ 9.1
6	+ 5.4	+13.6	-10.3	+16.0	+ .9	+ 9.3	- 3.1	+ 9.9
8	+ 7.4	+17.4	-20.1	+19.5	+ 2.4	+ 8.4	- 3.2	+ 8.7
9								
10								
11								

SHOT DATE COORDINATES SCREEN LOCATION	29 ² 16 Oct		30 16 Oct		31 16 Oct	
	X	Y	X	Y	X	Y
GUN	292.0	42.1	292.0	42.1	294.0	42.1
1	- 2.7	+ 9.4	- 1.3	+12.7	- 2.4	+11.6
6	-16.9	- 1.0			+ 1.7	+11.3
8					- 8.3	+ 6.7
9						
10						
11						

1. Projectile Break Up
2. Unstable

23.9 GRAIN FLECHETTE

SHOT DATE COORDINATES SCREEN LOCATION GUN	1 ² 2 Feb		2 ² 2 Feb		3 ² 2 Feb		4 ² 4 Feb	
	X	Y	X	Y	X	Y	X	Y
	340.0	40.5	340.0	40.5	340.0	40.5	344.0	40.5
1	+ .9	- .5	- .3	+ .8	- .1	0.0	+ .5	- .4
4	- 4.4	- 2.3	- 7.5	+13.0	-16.5	+ 7.4	+ 4.6	+ .1
5	- 8.5	- 1.6	- 8.0	+13.6	-23.0	+10.4	+ 5.8	+ 1.1
6	-10.5	- 4.3	- 6.9	+13.3	-26.4	+12.5	+ 7.5	+ 1.0

SHOT DATE GUN	5 ² 4 Feb		6 ² 4 Feb		7 4 Feb		8 ² 5 Feb	
	X	Y	X	Y	X	Y	X	Y
	344.0	40.5	344.0	40.5	344.0	40.5	348.0	40.5
1	+ .6	+ 1.5	+ 1.3	+ .9	+ .8	+ 1.1	+ .5	+ 1.0
4	+ 1.0	+ 8.5	+ 2.6	+ .3	+ 1.8	+ 1.3	- 6.5	+13.1
5	+ .1	+10.8	+ 2.3	+ 1.0	+ 1.5	+ 2.0	-10.6	+15.5
6	- .1	+11.6	+ 3.0	+ 1.3	+ 2.1	+ 1.8	-12.1	+17.4

SHOT DATE GUN	9 ² 5 Feb		10 ² 5 Feb		11 ² 5 Feb		12 ² 5 Feb	
	X	Y	X	Y	X	Y	X	Y
	348.0	40.5	348.0	40.5	348.0	40.5	352.0	40.5
1	+ .6	+ .9	+ 2.3	+ 1.3	+ 2.0	+ .4	+ .3	+ .7
4	- 2.4	- 5.4	+ 4.0	+ 6.0	+10.6	+ 2.3	-15.8	+10.9
5	- 1.5	-10.5	+ 1.3	+ 7.4	+15.1	+ 7.5	-27.0	+16.4
6	- .6	-14.9	+ .1	+ 7.6	+18.9	+11.8		

SHOT DATE GUN	13 ² 5 Feb		14 ² 5 Feb		15 ² 5 Feb		16 ² 5 Feb	
	X	Y	X	Y	X	Y	X	Y
	352.0	40.5	352.0	40.5	352.0	40.5	356.0	40.5
1	+ 1.5	+ .9	+ .4	+ .5	+ .9	+ .7	- .6	+ .3
4	-18.9	+ 1.1	+19.0	+ 1.9	- .3	+ 4.3	- 9.0	+ 1.0
5	-24.9	+ .5	+24.3	+ 2.3	- 6.0	+ 3.8	-10.1	+ 1.9
6			+27.1	+ 2.0	- 4.7	+ 2.8	-10.1	+ .9

SHOT DATE GUN	17 ² 5 Feb		18 ² 5 Feb		19 5 Feb		20 5 Feb	
	X	Y	X	Y	X	Y	X	Y
	356.0	40.5	356.0	40.5	360.0	40.5	360.0	40.5
1	+ .6	+ .5	+ .2	+ .7	0.0	- .1	- .1	+ .4
4	-10.5	+12.1	- 3.5	+11.4	- 1.9	+ .5	- 1.9	+ 2.0
5	-12.8	+17.5	- 3.6	+15.6	- 1.3	+ .8	- 1.4	+ 2.6
6					- .8	+ .3	- .9	+ 2.6

1. Projectile Break Up
2. Unstable

23.9 GRAIN FLECHETTE

SHOT	21 ²		22 ²		23 ²	
DATE	2 Feb		5 Feb		5 Feb	
COORDINATES	X	Y	X	Y	X	Y
SCREEN LOCATION						
GUN	340.0	40.5	356.0	40.5	360.0	40.5
1	+ .3	- .8	+ 1.6	+ 3.3	+ 1.0	+ .8
4			+ 1.8	+ 8.4		
5			- 4.1	+ 7.0		
6			- 6.1	+ 3.0		

1. Projectile Break Up
2. Unstable

10.3 GRAIN FLECHETTE

SHOT DATE COORDINATES SCREEN LOCATION GUN	1 ² 17 Feb		2 ² 17 Feb		3 ² 17 Feb		4 ² 17 Feb	
	X	Y	X	Y	X	Y	X	Y
1	388.0	40.5	392.0	40.5	392.0	40.5	392.0	40.5
4	- 1.6	+ 2.3	+ .6	+ 1.3	+ .8	+ .4	+ .4	+ 1.1
5	- 5.3	+ 5.3	+ 2.5	+ .5	- 2.9	- 4.9	- 7.7	-17.3
6	- 5.6	+ 5.1	+ 2.8	+ .5	- 4.3	- 5.3	-11.0	-26.0
	- 4.8	+ 5.5	+ 5.0	+ .1	- 3.6	- 5.6		

SHOT DATE GUN	5 ² 17 Feb		6 ² 18 Feb		7 ² 18 Feb		8 ² 18 Feb	
	X	Y	X	Y	X	Y	X	Y
1	392.0	40.5	396.0	40.5	396.0	40.5	396.0	40.5
4	+ .1	+ 1.2	+ .5	+ .5	+ 1.4	+ 1.1	+ 1.6	+ 1.3
5	+10.8	+ 1.6	- 5.0	+ 8.1	- 3.1	+ 7.0	- 3.5	- .8
6	+13.8	+ 1.2	- 8.3	+15.1	- 4.9	+ 8.4	- 6.3	- .3
	+19.3	- .4			- 3.9	+ 9.0	- 6.3	- .1

SHOT DATE GUN	9 ² 18 Feb		10 ² 18 Feb		11 ² 18 Feb		12 ² 18 Feb	
	X	Y	X	Y	X	Y	X	Y
1	400.0	40.5	400.0	40.5	400.0	40.5	404.0	40.5
4	+ 1.1	+ .9	+ .9	+ .8	+ 1.2	+ 1.0	+ 1.6	+ 1.4
5	+ 1.0	+ 7.3	+ 7.0	+ 3.6	+ 1.9	+ 2.3	- 1.5	+ 3.4
6	+ 1.4	+11.0	+ 6.0	+ 4.5	+ .9	+ 2.5	- 2.1	+ 3.8
	+ 4.5	+13.5	+ 8.5	+ 4.8	+ 3.1	+ 3.4	- .5	+ 3.9

SHOT DATE GUN	13 ² 18 Feb		14 ² 18 Feb		15 ² 18 Feb		16 ² 18 Feb	
	X	Y	X	Y	X	Y	X	Y
1	404.0	40.5	404.0	40.5	404.0	40.5	408.0	40.5
4	+ 1.6	+ 1.3	+ 1.5	+ 1.6	+ .5	+ .6	+ .3	+ .9
5	- .8	+ 3.3	+ 1.5	+ 3.0	- 4.5	+ .6	+10.6	+ 4.3
6	- 1.1	+ 3.6	+ 2.0	+ 1.5	- 4.0	+ 1.4	+11.4	+ 4.1
	+ 1.6	+ 3.8	+ 4.6	+ .6	- .6	+ 1.9	+14.1	+ 2.1

SHOT DATE GUN	17 ² 18 Feb		18 ² 18 Feb		19 ² 19 Feb		20 ² 19 Feb	
	X	Y	X	Y	X	Y	X	Y
1	408.0	40.5	408.0	40.5	412.0	40.5	412.0	40.5
4	- .4	+ 1.1	- .1	+ .9	- .5	+ .6	+ 1.2	+ 1.3
5	- 1.5	+ 1.9	+ 2.0	+ 7.9	- 3.6	- .8	+ 1.0	+ .8
6	- 2.1	+ 1.9	+ 4.4	+13.6	- 3.6	- 1.3	+ .1	+ .6
	+ .1	+ 1.9	+ 9.9	+17.3	- .8	- .8	+ 2.1	- .3

1. Projectile Break Up
2. Unstable

10.3 GRAIN FLECHETTE

SHOT DATE COORDINATES SCREEN LOCATION GUN	21 ² 17 Feb		22 ² 17 Feb		23 17 Feb		24 ² 18 Feb	
	X	Y	X	Y	X	Y	X	Y
	388.0	40.5	388.0	40.5	388.0	40.5	400.0	40.5
1	+ .5	+ 1.1	+ .3	0.0	- .1	+ .6	+ 1.5	+ .4
4	- 8.6	+15.0			+11.5	- 2.5	- 3.5	+13.8
5					+15.6	- 2.4		
6					+21.4	- 3.0		

SHOT DATE COORDINATES SCREEN LOCATION GUN	25 18 Feb		26 ² 17 Feb	
	X	Y	X	Y
	408.0	40.5	396.0	40.5
1	+ 1.0	+ .9	+ .9	+ 1.5
4	- .1	+ 2.3	+ 1.3	+11.1
5	- .6	+ 2.4	+ .3	+14.0
6	+ 2.1	+ 2.4	+ 2.0	+16.0

1. Projectile Break Up
2. Unstable

68.2 GRAIN 5.56 BALL

SHOT DATE COORDINATES SCREEN LOCATION GUN	1 ² 9 Feb		2 ² 9 Feb		3 ² 9 Feb		4 9 Feb	
	X	Y	X	Y	X	Y	X	Y
	364.0	40.4	364.0	40.4	364.0	40.4	368.0	40.4
1	+ .5	- .4	+ .4	0.0	+ .6	- .1	0.0	- .1
4	+ 2.2	- 1.4	+ 3.3	- 5.6	+ 1.8	- 2.1	- 2.3	- 2.1
5	+ 2.5	- 1.3	+ 4.0	- 7.0	+ 1.8	- 1.9	- 2.8	- 2.0
6	+ 3.5	- 2.1	+ 5.1	- 8.6	+ 2.6	- 2.3	- 2.1	- 2.7

SHOT DATE GUN	5 ² 9 Feb		6 ² 9 Feb		7 ² 9 Feb		8 ² 9 Feb	
	X	Y	X	Y	X	Y	X	Y
	368.0	40.4	368.0	40.4	372.0	40.4	372.0	40.4
1	+ .3	+ .1	+ 1.0	0.0	+ .6	+ .1	+ .6	- .1
4	- 5.6	+10.3	+ 3.3	- 1.1	0.0	+ 5.1	+ 4.8	- 3.6
5	- 7.1	+12.9	+ 3.3	+ .8	- 1.8	+ 9.6	+ 6.3	- 2.3
6	- 7.1	+14.5	+ 4.9	+ .6	- 1.8	+11.8	+ 9.0	- 3.0

SHOT DATE GUN	9 ¹ 9 Feb		10 ¹ 9 Feb		11 ² 9 Feb		12 ² 9 Feb	
	X	Y	X	Y	X	Y	X	Y
	372.0	40.4	372.0	40.4	376.0	40.4	376.0	40.4
1	- .5	- .1	- 1.0	+ .3	+ 1.9	- .4	+ .6	- .9
4	+ 4.5	- 1.4	- 2.4	+ .4	+ 6.6	- 5.4	+ 5.8	- 2.1
	+ 4.0	- 6.7	- 2.9	+ 3.5				
5	+ 3.6	- 2.9	+ .1	+ 3.3	+ 6.5	- 6.4	+ 5.3	- 2.4
	+ 1.4	-12.4	+ .8	- .6				
6	+ 6.3	- 2.6	+ 3.3	+ .6	+ 8.4	- 7.6	+ 6.9	- 3.2
	+ 5.3	-12.0						

SHOT DATE GUN	13 9 Feb		14 ² 9 Feb		15 ² 10 Feb		16 ² 10 Feb	
	X	Y	X	Y	X	Y	X	Y
	376.0	40.4	376.0	40.4	380.0	40.4	380.0	40.4
1	+ .5	- .3	- .3	- .3	+ 1.0	0.0	+ .4	+ .1
4	+ 2.3	+ 1.1	+ 1.2	+ .1	+ 6.8	+ 3.9	+ 1.4	- 1.0
5	+ 2.9	+ 2.6	+ 1.5	+ .4	+ 6.5	+ 5.3	- .1	- .9
6	+ 5.8	+ 2.9	+ 4.0	- .4				

SHOT DATE GUN	17 ² 10 Feb		18 ² 10 Feb		19 10 Feb		20 ² 10 Feb	
	X	Y	X	Y	X	Y	X	Y
	380.0	40.4	380.0	40.4	384.0	40.4	384.0	40.4
1	+ .1	+ .1	+ .3	+ .1	- .6	- .5	- 1.3	- .3
4	+ .9	- 1.5	- .1	+ 1.1	- 3.6	- 3.6	+ 5.3	- 8.4
5	- .4	- 1.1	0.0	+ 2.1	- 4.8	- 4.4	+ 5.8	-10.4

1. Projectile Break Up
2. Unstable

68.2 GRAIN 5.56 BALL

SHOT	21		22 ²		23 ²	
DATE	9 Feb		9 Feb		10 Feb	
COORDINATES	X	Y	X	Y	X	Y
SCREEN LOCATION						
GUN	364.0	40.4	364.0	40.4	384.0	40.4
1	+ 1.6	- .2	- .1	0.0	+ .1	- .3
4	+ 1.9	- 2.3	- 1.4	- 1.4	+ 3.4	- 2.4
5	+ 1.9	- 2.4	- 1.4	- .9	+ 3.5	- 3.9
6	+ 2.5	- 3.1	- .1	- 1.1		

1. Projectile Break Up
2. Unstable

APPENDIX III
CHARACTERIZATION DATA

APPENDIX III

CHARACTERIZATION DATA

The characterization data for projectiles a through d (Section I) are shown in Figures III-1 through III-3. As discussed in Section III, these data are from an area adjacent to the actual firing location. Figure III-1 shows the densities for each sub-area at different height intervals in the titi. The blackened areas were not characterized because they did not approximate the area fired through. Figure III-2 shows the stem diameter distribution of the titi at each height interval. Figure III-3 shows typical distribution of the position of the titi trunks at ground level.

The characterization data for projectiles e through h (Section I) are shown in Figure III-4. These data were obtained from the actual area where the shots were made. The coordinates of the area are shown. Only the density of the titi was obtained and only at the height interval through which the projectiles traveled. The sub-areas are plotted and the densities are shown for each.

		STEM WEIGHT (Pounds)	LEAF WEIGHT (Pounds)	TOTAL DENSITY (Lb/Cu Ft)	HEIGHT INTERVAL (Inches)
Z=90.0 Ft		5.14	1.47	4.41	0-19.7
Z=88.4 Ft		3.89	1.77	3.71	10.7-39.4
		1.57	1.24	1.87	39.4-59.1
		0.50	0.59	0.73	59.1-78.8
Z=82.2 Ft		11.75	0.76	8.02	0-19.7
Z=79.7 Ft		8.30	2.19	6.72	10.7-39.4
		4.44	1.53	3.83	39.4-59.1
		2.71	1.75	2.86	59.1-78.8
Z=73.1 Ft		14.29	0.43	10.22	0-19.7
Z=71.6 Ft		8.61	0.77	6.51	10.7-39.4
		5.99	1.43	5.15	39.4-59.1
		4.12	2.14	4.35	59.1-78.8
Z= 6.5 Ft		7.10	0.34	7.63	0-19.7
		4.05	0.99	5.17	10.7-39.4
		2.51	1.24	3.85	39.4-59.1
		1.30	0.67	2.02	59.1-78.8
Z=52.4 Ft		18.74	0.58	12.88	0-19.7
Z=48.1 Ft		10.66	1.13	7.86	10.7-39.4
Z=45.6 Ft		7.87	2.50	6.91	39.4-59.1
		4.72	2.13	4.57	59.1-78.8
Z=39.1 Ft		13.87	0.96	9.88	0-19.7
Z=36.6 Ft		8.63	1.28	6.61	10.7-39.4
		4.97	1.88	4.57	39.4-59.1
		3.22	1.28	3.00	59.1-78.8
Z=30.0 Ft					

4.9 Ft

Figure III-1. Titi Densities for Projectile Firings A through D (Various Height Intervals)

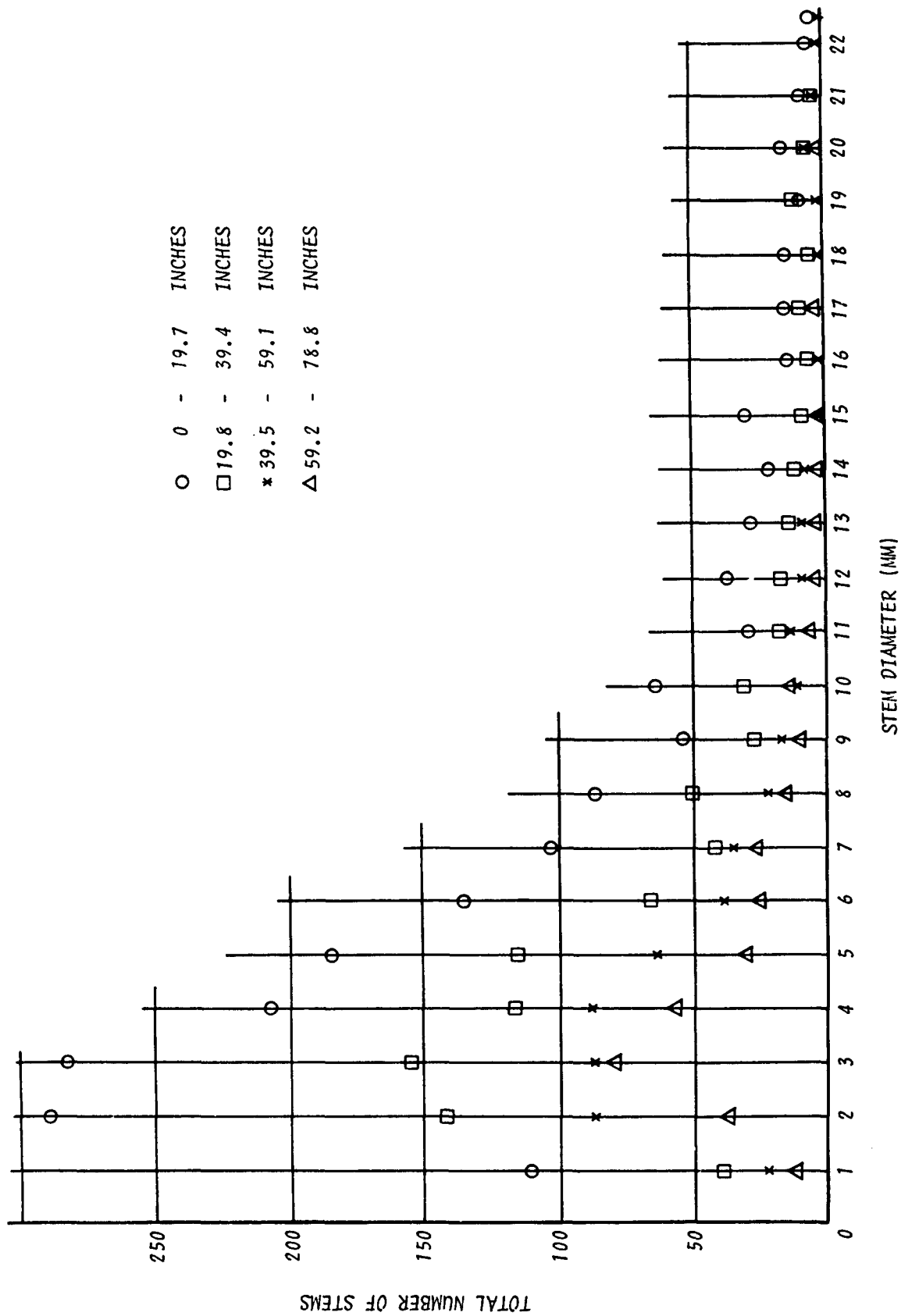


Figure III-2. Stem Diameter Distribution

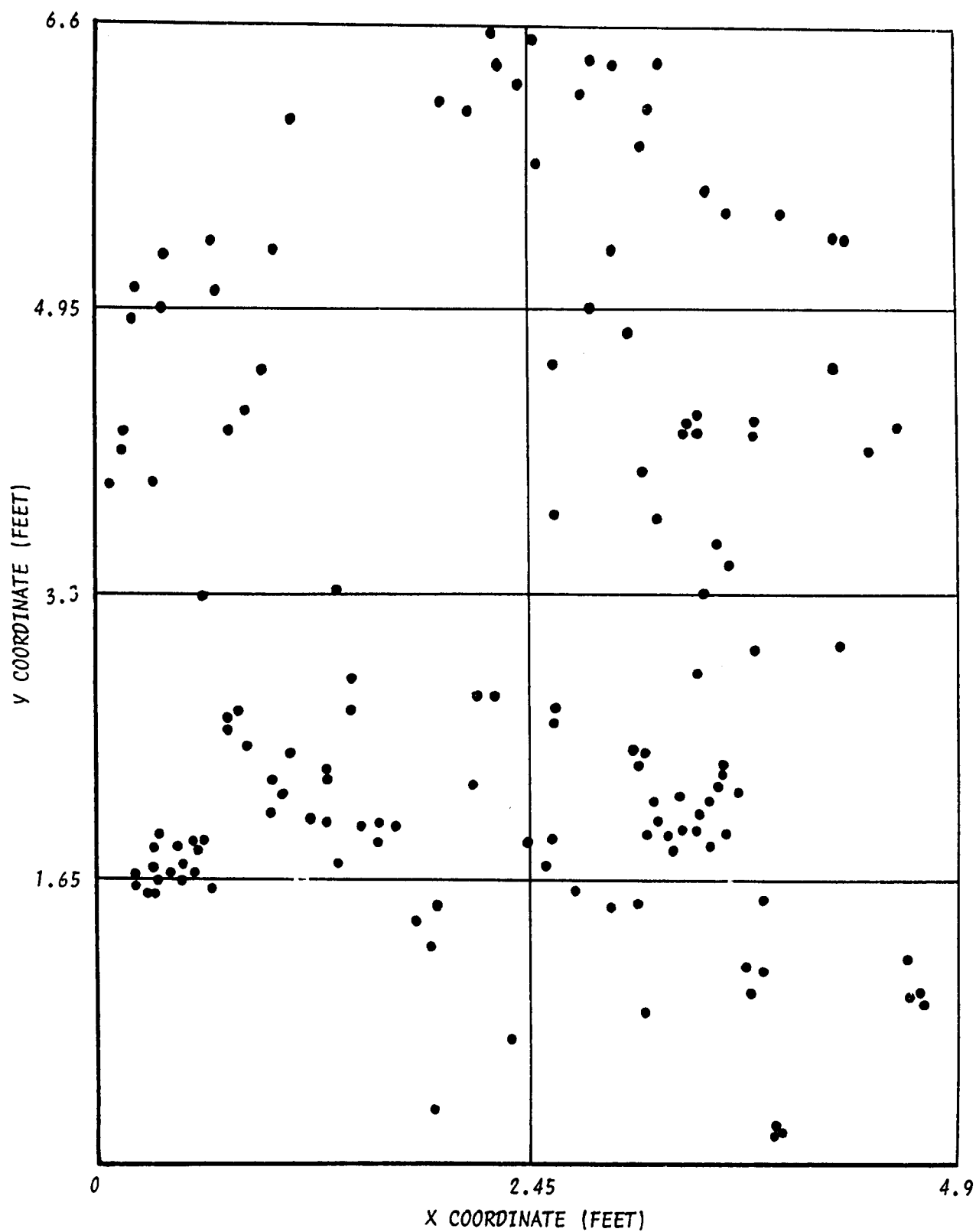


Figure III-3. Titi Trunk Distribution at Ground Level (Typical Area)

		Z=54 Feet	Z=53.75 Feet	Z=52.5 Feet
0.213	0.061	0.060	0.063	
0.163	0.202	0.069	0.389	Z=50 Feet
0.226	0.230	0.098	0.235	Z=45 Feet
0.329	0.108	0.137	0.290	Z=40 Feet
0.311	0.146	0.212	0.214	Z=35 Feet
				Z=30 Feet

X=36 Feet X=34 Feet X=32 Feet X=30 Feet X=28 Feet

NOTE: Numbers inside block indicate average density in pounds per cubic foot for that area.

Figure III-4. Titi Densities for Projectile Firings E through H (Height Interval 30 to 66 inches)